HOW WE THINK

A RESTATEMENT OF THE RELATION
OF REFLECTIVE THINKING TO
THE EDUCATIVE PROCESS

BY

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D. C. HEATH AND COMPANY

BOSTON

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PRINTED IN THE UNITED STATES OF AMERICA

PREFACE TO THE NEW EDITION

To say that a text is 'revised' may signify slight verbal changes or an extensive rewriting. The new edition of *How We Think,* which is presented herewith, is a revision of the latter sort. It is, as its subtitle indicates, a 'restatement' of *How We Think.*

In the first place, although some material found in the original edition has been excised, there has been considerable expansion. The present book contains nearly a quarter more than did the older account.

In the second place, the revision has been made with a view to increased definiteness and clearness of statement. Scrupulous pains have been taken to restate all ideas that were found by teachers to give undue trouble in understanding. The changes in this respect apply both to matters of phrasing, where a multitude of minor alterations have been made in the interests of greater sureness of comprehension, and also to the development of major ideas. The latter changes are most numerous and complete in Part II, the theoretical section of the book. There the whole logical analysis of reflection has been rewritten and, it is believed, very considerably simplified in statement. At the same time, the basic ideas, those that gave the original work its distinctive character, have not only been retained but have also been enriched and developed further. In the interests of clearness more illustrative material has been added, and some rearrangement of the position of entire chapters has been made.

In the third place, changes will be evident in the parts devoted to teaching. These changes reflect the large changes that have taken place in schools, especially in the manage-

ment of teaching and studying, since 1910, when the book first appeared. Some methods that were criticized because of their currency at that time have now practically disappeared from the better schools. New topics have come to the fore. Adjustments have accordingly been made in the text; for example, the present chapter on "The Recitation" is practically all new.

In conclusion, it is a great pleasure to express my thanks to the many teachers whose experience in using the older book has been freely put at my disposal in preparing the new and, I venture to hope, improved version.

JOHN DEWEY

PREFACE TO THE FIRST EDITION

Our schools are troubled with a multiplication of studies, each in turn having its own multiplication of materials and principles. Our teachers find their tasks made heavier in that they have come to deal with pupils individually and not merely in mass. Unless these steps in advance are to end in distraction, some clew of unity, some principle that makes for simplification, must be found. This book represents the conviction that the needed steadying and centralizing factor is found in adopting as the end of endeavor that attitude of mind, that habit of thought, which we call scientific. This scientific attitude of mind might, conceivably, be quite irrelevant to teaching children and youth. But this book also represents the conviction that such is not the case; that the native and unspoiled attitude of childhood, marked by ardent curiosity, fertile imagination, and love of experimental inquiry, is near, very near, to the attitude of the scientific mind. If these pages assist any to appreciate this kinship and to consider seriously how its recognition in educational practice would make for individual happiness and the reduction of social waste, the book will amply have served its purpose.

It is hardly necessary to enumerate the authors to whom I am indebted. My fundamental indebtedness is to my wife, by whom the ideas of this book were inspired, and through whose work in connection with the Laboratory School, existing in Chicago between 1896 and 1903, the ideas attained such concreteness as comes from embodiment and testing in practice. It is a pleasure, also, to acknowledge indebtedness to the intelligence and sympathy of those who coöperated as teachers and supervisors in the conduct of

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PART ONE

THE PROBLEM OF TRAINING THOUGHT

CHAPTER ONE

WHAT IS THINKING?

I. Different Meanings of Thought

The Best Way of Thinking

No one can tell another person in any definite way how he *should* think, any more than how he ought to breathe or to have his blood circulate. But the various ways in which men *do* think can be told and can be described in their general features. Some of these ways are better than others; the reasons why they are better can be set forth. The person who understands what the better ways of thinking are and why they are better can, if he will, change his own personal ways until they become more effective; until, that is to say, they do better the work that thinking can do and that other mental operations cannot do so well. The better way of thinking that is to be considered in this book is called reflective thinking: the kind of thinking that consists in turning a subject over in the mind and giving it serious and consecutive consideration. Before we take up this main theme, we shall, however, first take note briefly of some other mental processes to which the name *thought* is sometimes given.

The 'Stream of Consciousness'

All the time we are awake and sometimes when we are asleep, something is, as we say, going through our heads. When we are asleep we call that kind of sequence 'dreaming.' We also have daydreams, reveries, castles built in the

air, and mental streams that are even more idle and chaotic. To this uncontrolled coursing of ideas through our heads the name of 'thinking' is sometimes given. It is automatic and unregulated. Many a child has attempted to see whether he could not 'stop thinking' — that is, stop this procession of mental states through his mind — and in vain. More of our waking life than most of us would care to admit is whiled away in this inconsequential trifling with mental pictures, random recollections, pleasant but unfounded hopes, flitting, half-developed impressions. Hence it is that he who offers 'a penny for your thoughts' does not expect to drive any great bargain if his offer is taken; he will only find out what happens to be 'going through the mind' and what 'goes' in this fashion rarely leaves much that is worth while behind.

Reflective Thought Is a Chain

In this sense, silly folk and dullards *think*. The story is told of a man in slight repute for intelligence, who, desiring to be chosen selectman in his New England town, addressed a knot of neighbors in this wise: "I hear you don't believe I know enough to hold office. I wish you to understand that I am thinking about something or other most of the time." Now, reflective thought is like this random coursing of things through the mind in that it consists of a succession of things thought of, but it is unlike in that the mere chance occurrence of any chance 'something or other' in an irregular sequence does not suffice. Reflection involves not simply a sequence of ideas, but a *con*-sequence — a consecutive ordering in such a way that each determines the next as its proper outcome, while each outcome in turn leans back on, or refers to, its predecessors. The successive portions of a reflective thought grow out of one another and support one another; they do not come and go in a medley. Each phase is a step from something to something — technically speak-

ing, it is a *term* of thought. Each term leaves a deposit that is utilized in the next term. The stream or flow becomes a train or chain. There are in any reflective thought definite units that are linked together so that there is a sustained movement to a common end.

Thinking Usually Restricted to Things Not Directly Perceived

The second meaning of thinking limits it to things not sensed or directly perceived, to things *not* seen, heard, touched, smelt, or tasted. We ask the man telling a story if he saw a certain incident happen, and his reply may be, "No, I only thought of it." A note of invention, as distinct from faithful record of observation, is present. Most important in this class are successions of imaginative incidents and episodes that have a certain coherence, hang together on a continuous thread, and thus lie between kaleidoscopic flights of fancy and considerations deliberately employed to establish a conclusion. The imaginative stories poured forth by children possess all degrees of internal congruity; some are disjointed, some are articulated. When connected, they simulate reflective thought; indeed, they usually occur in minds of logical capacity. These imaginative enterprises often precede thinking of the close-knit type and prepare the way for it. In this sense a thought or idea is a mental picture of something not actually present, and thinking is the succession of such pictures.

Reflective Thinking Aims at a Conclusion

In contrast, reflective thinking has a purpose beyond the entertainment afforded by the train of agreeable mental inventions and pictures. The train must lead somewhere; it must tend to a conclusion that can be substantiated outside the course of the images. A story of a giant may satisfy merely because of the story itself; a reflective conclusion

that a giant lived at a certain date and place on the earth would have to have some justification outside of the chain of ideas in order to be a valid or sound conclusion. This contrasting element is probably best conveyed in the ordinary saying: "Think it *out*." The phrase suggests an entanglement to be straightened out, something obscure to be cleared up through the application of thought. There is a goal to be reached, and this end sets a task that controls the sequence of ideas.

Thinking as Practically Synonymous with Believing

A third meaning of thought is practically synonymous with *belief*. "I think it is going to be colder tomorrow," or "I think Hungary is larger than Jugo-Slavia" is equivalent to "I believe so-and-so." When we say, "Men used to think the world was flat," we obviously refer to a belief that was held by our ancestors. This meaning of thought is narrower than those previously mentioned. A belief refers to something beyond itself by which its value is tested; it makes an assertion about some matter of fact or some principle or law. It means that a specified state of fact or law is accepted or rejected, that it is something proper to be affirmed or at least acquiesced in. It is hardly necessary to lay stress upon the importance of belief. It covers all the matters of which we have no sure knowledge and yet which we are sufficiently confident of to act upon and also the matters that we now accept as certainly true, as knowledge, but which nevertheless may be questioned in the future — just as much that passed as knowledge in the past has now passed into the limbo of mere opinion or of error.

There is nothing in the mere fact of thought as identical with belief that reveals whether the belief is well founded or not. Two different men say, "I believe the world is spherical." One man, if challenged, could produce little or no evi-

dence for thinking as he does. It is an idea that he has picked up from others and that he accepts because the idea is generally current, not because he has examined into the matter and not because his own mind has taken any active part in reaching and framing the belief.

Such 'thoughts' grow up unconsciously. They are picked up — we know not how. From obscure sources and by unnoticed channels they insinuate themselves into the mind and become unconsciously a part of our mental furniture. Tradition, instruction, imitation — all of which depend upon authority in some form, or appeal to our own advantage, or fall in with a strong passion — are responsible for them. Such thoughts are prejudices; that is, prejudgments, not conclusions reached as the result of personal mental activity, such as observing, collecting, and examining evidence. Even when they happen to be correct, their correctness is a matter of accident as far as the person who entertains them is concerned.

Reflective Thinking Impels to Inquiry

Thus we are brought again, by way of contrast, to the particular kind of thinking that we are to study in this volume, *reflective thinking*. Thought, in the two first senses mentioned, may be harmful to the mind because it distracts attention from the real world, and because it may be a waste of time. On the other hand, if indulged in judiciously these thoughts may afford genuine enjoyment and also be a source of needed recreation. But in either case they can make no claim to truth; they cannot hold themselves up as something that the mind should accept, assert, and be willing to act upon. They may involve a kind of emotional commitment, but not intellectual and practical commitment. Beliefs, on the other hand, do involve precisely this commitment and consequently sooner or later they demand our

investigation to find out upon what grounds they rest. To think of a cloud as a whale or a camel — in the sense of to 'fancy' — does not commit one to the conclusion that the person having the idea would ride the camel or extract oil from the whale. But when Columbus 'thought' the world was round, in the sense of 'believed it to be so,' he and his followers were thereby committed to a series of other beliefs and actions: to beliefs about routes to India, about what would happen if ships traveled far westward on the Atlantic, etc., precisely as thinking that the world was flat had committed those who held it to belief in the impossibility of circumnavigation, and in the limitation of the earth to regions in the small civilized part of it Europeans were already acquainted with, etc.

The earlier thought, belief in the flatness of the earth, had some foundation in evidence; it rested upon what men could see easily within the limits of their vision. But this evidence was not further looked into; it was not checked by considering other evidence; there was no search for new evidence. Ultimately the belief rested on laziness, inertia, custom, absence of courage and energy in investigation. The later belief rests upon careful and extensive study, upon purposeful widening of the area of observation, upon reasoning out the conclusions of alternative conceptions to see what would follow in case one or the other were adopted for belief. As distinct from the first kind of thinking there was an orderly chain of ideas; as distinct from the second, there was a controlling purpose and end; as distinct from the third, there was personal examination, scrutiny, inquiry.

Because Columbus did not accept unhesitatingly the current traditional theory, because he doubted and inquired, he arrived at his thought. Skeptical of what, from long habit, seemed most certain, and credulous of what seemed impossible, he went on thinking until he could produce evidence

for both his confidence and his disbelief. Even if his conclusion had finally turned out wrong, it would have been a different sort of belief from those it antagonized, because it was reached by a different method. *Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends* constitutes reflective thought. Any one of the first three kinds of thought may elicit this type; but once begun, it includes a conscious and voluntary effort to establish belief upon a firm basis of evidence and rationality.

II. The Central Factor in Thinking

The Suggestion of Something Not Observed

There are, however, no sharp lines of demarcation between the various operations just outlined. The problem of attaining correct habits of reflection would be much easier than it is, did not the different modes of thinking blend insensibly into one another. So far, we have considered rather extreme instances of each kind in order to get the field clearly before us. Let us now reverse this operation; let us consider a rudimentary case of thinking, lying between careful examination of evidence and a mere irresponsible stream of fancies. A man is walking on a warm day. The sky was clear the last time he observed it; but presently he notes, while occupied primarily with other things, that the air is cooler. It occurs to him that it is probably going to rain; looking up, he sees a dark cloud between him and the sun, and he then quickens his steps. What, if anything, in such a situation can be called thought? Neither the act of walking nor the noting of the cold is a thought. Walking is one direction of activity; looking and noting are other modes of ac-

tivity. The likelihood that it will rain is, however, something *suggested.* The pedestrian *feels* the cold; first he *thinks* of clouds, then he looks and perceives them, and then he thinks of something he does not see: a storm. This *suggested possibility* is the idea, the thought. If it is believed in as a genuine possibility which may occur, it is the kind of thought which falls within the scope of knowledge and which requires reflective consideration.

Up to a certain point there is the same sort of situation as when one who looks at a cloud is reminded of a human figure and face. Thinking in both of these cases (the cases of belief and of fancy) involves noting or perceiving a fact, followed by something else that is not observed but that is brought to mind, suggested by the thing seen. One thing reminds us, as we say, of the other. Side by side, however, with this factor of agreement in the two cases of suggestion is a factor of marked disagreement. We do not *believe* in the face suggested by the cloud; we do not consider at all the probability of its being a fact. There is no *reflective* thought. The danger of rain, on the contrary, presents itself to us as a genuine possibility — a fact of the same nature as the observed coolness. Put differently, we do not regard the cloud as meaning or indicating a face, but merely as suggesting it, while we do consider that the coolness may *mean* rain. In the first case, on seeing an object, we just happen, as we say, to think of something else; in the second, we consider the *possibility and nature of the connection between the object seen and the object suggested.* The seen thing is regarded as in some way *the ground or basis of belief* in the suggested thing; it possesses the quality of *evidence.*

The Function of Signifying

This function whereby one thing signifies or indicates another, thus leading us to consider how far the one may

be regarded as warrant for belief in the other, is, then, the central factor in all reflective or distinctively intellectual thinking. By calling up various situations to which such terms as *signifies* and *indicates* apply, the student will realize for himself the actual facts denoted. Synonyms for these terms are: points to, tells of, betokens, prognosticates, represents, stands for, implies.[1] We also say one thing portends another, is ominous of another, or a symptom of it, or a key to it, or (if the connection is quite obscure) that it gives a hint, clue, or intimation. Reflection is not identical with the mere fact that one thing indicates, means, another thing. It commences when we begin to inquire into the reliability, the worth, of any particular indication; when we try to test its value and see what guarantee there is that the existing data *really* point to the idea that is suggested in such a way as to *justify* acceptance of the latter.

Reflection Implies Belief on Evidence

Reflection thus implies that something is believed in (or disbelieved in), not on its own direct account, but through something else which stands as witness, evidence, proof, voucher, warrant; that is, as *ground of belief*. At one time, rain is actually felt or directly experienced; at another time, we *infer* that it has rained from the appearance of the grass and trees, or that it is going to rain because of the condition of the air or the state of the barometer. At one time, we see a man (or suppose we do) without any intermediary fact; at another time, we are not quite sure what we see, and hunt for accompanying facts that will serve as signs, indications, tokens of what we are to believe.

[1] *Implies* is more often used when a principle or general truth brings about belief in some other truth; the other phrases are more frequently used to denote the cases in which a fact or event leads us to believe in some other fact or in a law.

Thinking, for the purposes of this inquiry, is accordingly defined as *that operation in which present facts suggest other facts* (or *truths*) *in such a way as to induce belief in what is suggested on the ground of real relation in the things themselves*, a relation between what suggests and what is suggested. A cloud *suggests* a weasel or a whale; it does not *mean* the latter, because there is no tie, or bond, in the things themselves between what is seen and what is suggested. Ashes not merely suggest a previous fire, but they signify there has been a fire, because ashes are produced by combustion and, if they are genuine ashes, only by combustion. It is an objective connection, the link in actual things, that makes one thing the ground, warrant, evidence, for believing in something else.

III. Phases of Reflective Thinking

We may carry our account further by noting that *reflective* thinking, in distinction from other operations to which we apply the name of thought, involves (1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and (2) an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity.

The Importance of Uncertainty and of Inquiry

In our illustration, the shock of coolness generated confusion and suspended belief, at least momentarily. Because it was unexpected, it was a shock or an interruption needing to be accounted for, identified, or placed. To say that the abrupt occurrence of the change of temperature constitutes a problem may sound forced and artificial; but if we are willing to extend the meaning of the word *problem* to what-

ever — no matter how slight and commonplace in character — perplexes and challenges the mind so that it makes belief at all uncertain, there is a genuine problem, or question, involved in an experience of sudden change.

The turning of the head, the lifting of the eyes, the scanning of the heavens, are activities adapted to bring to recognition facts that will answer the question presented by the sudden coolness. The facts as they first presented themselves were perplexing; they suggested, however, clouds. The act of looking was an act to discover whether this suggested explanation held good. It may again seem forced to speak of this looking, almost automatic, as an act of research, or inquiry. But once more, if we are willing to generalize our conceptions of our mental operations to include the trivial and ordinary as well as the technical and recondite, there is no good reason for refusing to give this title to the act of looking. For the result of the act is to bring facts before the mind that enable a person to reach a conclusion on the basis of evidence. In so far, then, as the act of looking was deliberate, was performed with the intention of getting an external basis on which to rest a belief, it exemplifies in an elementary way the operation of hunting, searching, inquiring, involved in any reflective operation.

Another instance, commonplace also, yet not quite so trivial, may enforce this lesson. A man traveling in an unfamiliar region comes to a branching of the road. Having no sure knowledge to fall back upon, he is brought to a standstill of hesitation and suspense. Which road is right? And how shall his perplexity be resolved? There are but two alternatives: he must either blindly and arbitrarily take his course, trusting to luck for the outcome, or he must discover grounds for the conclusion that a given road is right. Any attempt to decide the matter by thinking will involve inquiring into other facts, whether brought to mind by mem-

ory, or by further observation, or by both. The perplexed wayfarer must carefully scrutinize what is before him and he must cudgel his memory. He looks for evidence that will support belief in favor of either of the roads — for evidence that will weight down one suggestion. He may climb a tree; he may go first in this direction, then in that, looking, in either case, for signs, clues, indications. He wants something in the nature of a signboard or a map, and *his reflection is aimed at the discovery of facts that will serve this purpose.*

The foregoing illustration may be generalized. Thinking begins in what may fairly enough be called a *forked-road* situation, a situation that is ambiguous, that presents a dilemma, that proposes alternatives. As long as our activity glides smoothly along from one thing to another, or as long as we permit our imagination to entertain fancies at pleasure, there is no call for reflection. Difficulty or obstruction in the way of reaching a belief brings us, however, to a pause. In the suspense of uncertainty, we metaphorically climb a tree; we try to find some standpoint from which we may survey additional facts and, getting a more commanding view of the situation, decide how the facts stand related to one another.

The Regulation of Thinking by Its Purpose

Demand for the solution of a perplexity is the steadying and guiding factor in the entire process of reflection. Where there is no question of a problem to be solved or a difficulty to be surmounted, the course of suggestions flows on at random; we have the first type of thought described. If the stream of suggestions is controlled simply by their emotional congruity, their fitting agreeably into a single picture or story, we have the second type. But a question to be answered, an ambiguity to be resolved, sets up an end and holds the current of ideas to a definite channel. Every

suggested conclusion is tested by its reference to this regulating end, by its pertinence to the problem in hand. This need of straightening out a perplexity also controls the kind of inquiry undertaken. A traveler whose end is the most beautiful path will look for other signs and will test suggestions on another basis than if he wishes to discover the way to a given city. *The nature of the problem fixes the end of thought,* and *the end controls the process of thinking.*

IV. Summary

We may recapitulate by saying that the origin of thinking is some perplexity, confusion, or doubt. Thinking is not a case of spontaneous combustion; it does not occur just on 'general principles.' There is something that occasions and evokes it. General appeals to a child (or to a grown-up) to think, irrespective of the existence in his own experience of some difficulty that troubles him and disturbs his equilibrium, are as futile as advice to lift himself by his boot-straps.

Given a difficulty, the next step is suggestion of some way out — the formation of some tentative plan or project, the entertaining of some theory that will account for the peculiarities in question, the consideration of some solution for the problem. The data at hand cannot supply the solution; they can only suggest it. What, then, are the sources of the suggestion? Clearly, past experience and a fund of relevant knowledge at one's command. If the person has had some acquaintance with similar situations, if he has dealt with material of the same sort before, suggestions more or less apt and helpful will arise. But unless there has been some analogous experience, confusion remains mere confusion. Even when a child (or a grown-up) has a problem,

it is wholly futile to urge him to think when he has no prior experiences that involve some of the same conditions.

There may, however, be a state of perplexity and also previous experience out of which suggestions emerge, and yet thinking need not be reflective. For the person may not be sufficiently *critical* about the ideas that occur to him. He may jump at a conclusion without weighing the grounds on which it rests; he may forego or unduly shorten the act of hunting, inquiring; he may take the first 'answer,' or solution, that comes to him because of mental sloth, torpor, impatience to get something settled. One can think reflectively only when one is willing to endure suspense and to undergo the trouble of searching. To many persons both suspense of judgment and intellectual search are disagreeable; they want to get them ended as soon as possible. They cultivate an over-positive and dogmatic habit of mind, or feel perhaps that a condition of doubt will be regarded as evidence of mental inferiority. It is at the point where examination and test enter into investigation that the difference between reflective thought and bad thinking comes in. To be genuinely thoughtful, we must be willing to sustain and protract that state of doubt which is the stimulus to thorough inquiry, so as not to accept an idea or make positive assertion of a belief until justifying reasons have been found.

CHAPTER TWO

WHY REFLECTIVE THINKING MUST BE AN EDUCATIONAL AIM

I. The Values of Thinking

It Makes Possible Action with a Conscious Aim

We all acknowledge, in words at least, that ability to think is highly important; it is regarded as the distinguishing power that marks man off from the lower animals. But since our ordinary notions of how and why thinking is important are vague, it is worth while to state explicitly the values possessed by reflective thought. In the first place, it emancipates us from merely impulsive and merely routine activity. Put in positive terms, thinking enables us to direct our activities with foresight and to plan according to ends-in-view, or purposes of which we are aware. It enables us to act in deliberate and intentional fashion to attain future objects or to come into command of what is now distant and lacking. By putting the consequences of different ways and lines of action before the mind, it enables us to *know what we are about* when we act. *It converts action that is merely appetitive, blind, and impulsive into intelligent action.* A brute animal, as far as we know, is pushed on from behind; it is moved in accordance with its present physiological state by some present external stimulus. The being who can think is moved by remote considerations, by results that can be attained perhaps only after a lapse of years — as when a young person sets out

to gain a professional education to fit himself for a career in years to come.

For example, an animal without thought will go into its hole when rain threatens, because of some immediate stimulus to its organism. But a thinking being will perceive that certain given facts are probable signs of a future rain and will take steps in the light of this anticipated future. To plant seeds, to cultivate the soil, to harvest grain, are intentional acts, possible only to a being who has learned to subordinate the immediately felt elements of an experience to those values which these elements hint at and prophesy. Philosophers have made much of the phrases 'book of nature,' 'language of nature.' Well, it is in virtue of thought that given things are significant of absent things and that nature speaks a language which may be interpreted. To a being who thinks, things are records of their past, as fossils tell of the prior history of the earth, and are prophetic of their future, as from the present positions of heavenly bodies remote eclipses are foretold. Shakespeare's "tongues in trees, books in the running brooks," expresses literally enough the power superadded to existences when they are used by a thinking being. Only when things about us have meaning for us, only when they signify consequences that can be reached by using them in certain ways, is any such thing as intentional, deliberate control of them possible.

It Makes Possible Systematic Preparations and Inventions

By thought man also develops and arranges artificial signs to remind him in advance of consequences and of ways of securing and avoiding them. As the trait just mentioned makes the difference between savage man and brute; so this trait makes the difference between civilized man and savage. A savage who has been shipwrecked on a river may note certain things that serve him as signs of

danger in the future. But civilized man deliberately *makes* such signs; he sets up in advance of any particular shipwreck warning buoys, and builds lighthouses where he sees signs that such an event may occur. A savage reads weather signs with great expertness; civilized man institutes a weather service by which signs are artificially secured and information is distributed in advance of the appearance of any signs that could be detected without special methods. A savage finds his way skillfully through a wilderness by reading certain obscure indications; civilized man builds a highway that shows the road to all. The savage learns to detect the signs of fire and thereby to invent methods of producing flame; civilized man discovers illuminating gas and oils, and invents lamps, electric lights, stoves, furnaces, central heating plants, etc. The very essence of civilized culture is that we deliberately erect monuments and memorials, lest we forget; and deliberately institute, in advance of the happening of various contingencies and emergencies of life, devices for detecting their approach and registering their nature, for warding off what is unfavorable, or at least for protecting ourselves from its full impact and for making more secure and extensive what is favorable. All forms of artificial apparatus are intentional modifications of natural things so designed that they may serve better than in their natural estate to indicate the hidden, the absent, and the remote.

It Enriches Things with Meanings

Finally, thought confers upon physical events and objects a very different status and value from those which they possess to a being that does not reflect. These words are mere scratches, curious variations of light and shade, to one to whom they are not linguistic signs. To him for whom they are signs of other things, the collection of marks

stands for some idea or object. We are so used to the fact that things have meaning for us, that they are not mere excitations of sense organs, that we fail to recognize that they are charged with the significance they have only because in the past absent things have been suggested to us by what is present and these suggestions have been confirmed in subsequent experience. If we stumble against something in the dark, we may react to it and get out of the way to save ourselves a bruise or a tumble without recognizing what particular *object* it is. We react almost automatically to many stimuli; they have no meaning for us or are not definite individual objects. For an *object* is more than a mere *thing;* it is a thing having a definite significance.

The distinction we are making can be most readily understood if the reader will call to mind things and events that are strange to him and compare them with the same things and events as they appear to persons having expert knowledge of them; or if he will compare a thing or event as it is *before*, with what it is *after*, he has obtained intellectual mastery over it. To a layman a particular body of water may signify only something to wash with or to drink; to another person it may stand for a union of two chemical elements, themselves not liquids but gases; or it may signify something that should *not* be drunk because of danger of typhoid fever. To a baby things are at first only patterns of color and light, sources of sound; they acquire meaning only as they become signs of possible, but not yet present and actual, experiences. To the learned scientific man, the range of meanings possessed by ordinary things is much widened. A stone is not merely a stone; it is a stone of a given mineralogical type, from a particular geological stratum, etc. It tells him something about what happened millions of years ago, and helps paint the picture of the earth's history.

Control and Enriched Value

The first two values mentioned are of a practical sort; they give increased power of *control.* The value just mentioned is an enrichment of meaning apart from added control — a certain event in the heavens cannot be warded off just because we know it is an eclipse and how it is produced, but it does have a significance for us that it did not have before. We may not need to do any thinking now when some event occurs, but if we have thought about it before, the outcome of that thinking is funded as a directly added and deepened meaning of the event. The great reward of exercising the power of thinking is that there are no limits to the possibility of carrying over into the objects and events of life, meanings originally acquired by thoughtful examination, and hence no limit to the continual growth of meaning in human life. A child to-day may see meanings in things that were hidden from Ptolemy and Copernicus because of the results of reflective investigations that have occurred in the meantime.

Various values of the power of thought are summed up in the following quotation from John Stuart Mill.

> To draw inferences has been said to be the great business of life. Every one has daily, hourly, and momentary need of ascertaining facts which he has not directly observed: not from any general purpose of adding to his stock of knowledge, but because the facts themselves are of importance to his interests or to his occupations. The business of the magistrate, of the military commander, of the navigator, of the physician, of the agriculturist, *is merely to judge of evidence and to act accordingly.* . . . As they do this well or ill, so they discharge well or ill the duties of their several callings. *It is the only occupation in which the mind never ceases to be engaged.*[1]

[1] Mill, *System of Logic,* Introduction, § 5.

Two Reasons for Training Thought

These three values, in their cumulative effect, make the difference between a truly human and rational life and the existence lived by those animals that are immersed in sensation and appetite. Beyond a somewhat narrow limit, enforced by the necessities of life, the values that have been described do not, however, automatically realize themselves. For anything approaching their adequate realization, thought needs careful and attentive educational direction. Nor is that the whole story. Thinking may develop in positively wrong ways and lead to false and harmful beliefs. The need of systematic training would be less than it is if the only danger to be feared were lack of any development; the evil of the wrong kind of development is even greater.

An earlier writer than Mill, John Locke (1632–1704), brings out the importance of thought for life and the need of training so that its best and not its worst possibilities will be realized, in the following words:

> No man ever sets himself about anything but upon some view or other, which serves him for a reason for what he does; and whatsoever faculties he employs, the understanding with such light as it has, well or ill informed, constantly leads; and by that light, true or false, all his operative powers are directed. . . . Temples have their sacred images, and we see what influence they have always had over a great part of mankind. But in truth the ideas and images in men's minds are the invisible powers that constantly govern them, and to these they all, universally, pay a ready submission. It is therefore of the highest concernment that great care should be taken of the understanding, to conduct it aright in the search of knowledge and in judgments it makes.[2]

[2] Locke, *The Conduct of the Understanding*, first paragraph.

While the power of thought, then, frees us from servile subjection to instinct, appetite, and routine, it also brings with it the occasion and possibility of error and mistake. In elevating us above the brute, it opens the possibility of failures to which the animal, limited to instinct, cannot sink.

II. Tendencies Needing Constant Regulation

Physical and Social Sanctions of Correct Thinking

Up to a certain point, the necessities of life enforce a fundamental and persistent discipline of thought for which the most cunningly devised artifices would be ineffective substitutes. The burnt child dreads the fire; a painful consequence emphasizes the need of correct inference much more than would learned discourses on the properties of heat. Social conditions also put a premium on correct inference in matters where action based on valid thought is socially important. These sanctions of proper thinking may affect life itself, or at least a life reasonably free from perpetual discomfort. The signs of enemies, of shelter, of food, of the main social conditions, have to be correctly apprehended.

But this disciplinary training, efficacious as it is within certain limits, does not carry us far. Logical attainment in one direction is no bar to extravagant conclusions in another. A savage who is expert in judging the movements and location of the animals that he hunts will accept and gravely narrate the most preposterous yarns concerning the origin of their habits and peculiarities of structure. When there is no direct appreciable reaction of the inference upon the security and prosperity of life, there are no natural checks to the acceptance of wrong beliefs. Conclusions may be accepted merely because the suggestions are vivid and

interesting, while a large accumulation of dependable data may fail to suggest a proper conclusion because of opposition from existing customs. Then there is a 'primitive credulity,' a natural tendency to believe anything that is suggested unless there is overpowering evidence to the contrary. It sometimes seems, upon surveying the history of thought, that men exhausted pretty much all wrong forms of belief before they hit upon the right conceptions. The history of scientific beliefs also shows that when a wrong theory once gets general acceptance, men will expend ingenuity of thought in buttressing it with additional errors rather than surrender it and start in a new direction: witness for example the elaborate pains taken to preserve the Ptolemaic theory of the solar system. Even to-day correct beliefs about the constitution of nature are held by the great multitude merely because they are current and popular rather than because the multitude understands the reasons upon which they rest.

Superstition Is as Natural as Science

As to the mere function of suggestion, there is no difference between the power of a column of mercury to portend rain and that of the entrails of an animal or the flight of birds to foretell the fortunes of war. For all anybody can tell in advance, the spilling of salt is as likely to import bad luck as the bite of a mosquito to import malaria. Only systematic regulation of the conditions under which observations are made and severe discipline of the habits of entertaining suggestions can secure a decision that one type of belief is vicious and the other sound. The substitution of scientific for superstitious habits of inference has not been brought about by any improvement in the acuteness of the senses or in the natural workings of the function of suggestion. It is the result of regulation *of the conditions*

under which observation and inference take place. When such regulation is absent, dreams, the position of stars, the lines of the hand, are regarded as valuable signs, and the fall of cards as an inevitable omen, while natural events of the most crucial significance go disregarded. Hence beliefs in portents of various kinds, now mere nook-and-cranny superstitions, were once universal. A long discipline in exact science was required for their conquest.

The General Causes of Bad Thinking: Bacon's "Idols"

It is instructive to note some of the attempts that have been made to classify the main sources of error in reaching beliefs. Francis Bacon, for example, at the beginning of modern scientific inquiry, enumerated four such classes, under the somewhat fantastic title of "idols" (Gr. *εἴδωλα*, images), spectral forms that allure the mind into false paths. These he called the idols, or phantoms, of (*a*) the tribe, (*b*) the market place, (*c*) the cave or den, and (*d*) the theatre; or, less metaphorically, (*a*) standing erroneous methods (or at least temptations to error) that have their roots in human nature generally, (*b*) those that come from intercourse and language, (*c*) those that are due to causes peculiar to a specific individual, and finally, (*d*) those that have their sources in the fashion or general current of a period. Classifying these causes of fallacious belief somewhat differently, we may say that two are intrinsic and two are extrinsic. Of the intrinsic, one is common to all men alike (such as the universal tendency to notice instances that corroborate a favorite belief more readily than those that contradict it), while the other resides in the specific temperament and habits of the given individual. Of the extrinsic, one proceeds from generic social conditions — like the tendency to suppose that there is a fact wherever there is a word, and no fact where there is no

linguistic term — while the other proceeds from local and temporary social currents.

Locke on Typical Forms of Wrong Belief

Locke's method of dealing with typical forms of wrong belief is less formal and may be more enlightening. We can hardly do better than quote his forcible and quaint language, when, enumerating different classes of men, he shows different ways in which thought goes wrong:

> (*a*) The first is of those who seldom reason at all, but do and think according to the example of others, whether parents, neighbors, ministers, or who else they are pleased to make choice of to have an implicit faith in, for the saving of themselves the pains and troubles of thinking and examining for themselves.
>
> (*b*) This kind is of those who put passion in the place of reason, and being resolved that shall govern their actions and arguments, neither use their own, nor hearken to other people's reason, any farther than it suits their humor, interest, or party.[3]
>
> (*c*) The third sort is of those who readily and sincerely follow reason, but for want of having that which one may call large, sound, roundabout sense, have not a full view of all that relates to the question. . . . They converse but with one sort of men, they read but one sort of books, they will not come in the hearing but of one sort of notions. . . . They have a pretty traffic with known correspondents in some little creek . . . but will not venture out into the great ocean of knowledge. [Men of originally equal natural parts may finally

[3] In another place Locke says: "Men's prejudices and inclinations impose often upon themselves. . . . Inclination suggests and slides into discourse favorable terms, which introduce favorable ideas; till at last by this means that is concluded clear and evident, thus dressed up, which, taken in its native state, by making use of none but precise determined ideas, would find no admittance at all."

arrive at very different stores of knowledge and truth] when all the odds between them has been the different scope that has been given to their understandings to range in, for the gathering up of information and furnishing their heads with ideas and notions and observations, whereon to employ their mind.[4]

In another portion of his writings,[5] Locke states the same ideas in slightly different form.

1. That which is inconsistent with our *principles* is so far from passing for probable with us that it will not be allowed possible. The reverence borne to these principles is so great, and their authority so paramount to all other, that the testimony, not only of other men, but the evidence of our own senses are often rejected, when they offer to vouch anything contrary to these *established rules*. . . . There is nothing more ordinary than children's receiving into their minds propositions . . . from their parents, nurses, or those about them; which being insinuated in their unwary as well as unbiased understandings, and fastened by degrees, are at last (and this whether true or false) riveted there by long custom and education, beyond all possibility of being pulled out again. For men, when they are grown up, reflecting upon their opinions and finding those of this sort to be as ancient in their minds as their very memories, not having observed their early insinuation, nor by what means they got them, they are apt to reverence them as sacred things, and not to suffer them to be profaned, touched, or questioned. [They take them as standards] to be the great and unerring deciders of truth and falsehood, and the judges to which they are to appeal in all manner of controversies.

2. Secondly, next to these are men whose understandings are cast into a mold, and fashioned just to the size of a received hypothesis. [Such men, while not denying the existence of facts

[4] *The Conduct of the Understanding*, § 3.

[5] *Essay Concerning Human Understanding*, Bk. IV, Ch. XX, "Of Wrong Assent or Error."

and evidence, cannot be convinced even by the evidence that would decide them if their minds were not so closed by adherence to fixed belief.]

3. Predominant Passions. Thirdly, probabilities which cross men's appetites and prevailing passions run the same fate. Let ever so much probability hang on one side of a covetous man's reasoning, and money on the other, it is easy to foresee which will outweigh. Earthly minds, like mud walls, resist the strongest batteries.

4. Authority. The fourth and last wrong measure of probability I shall take notice of, and which keeps in ignorance or error more people than all the others together, is the giving up our assent to the common received opinions, either of our friends or party, neighborhood or country.

Importance of Attitudes

We have quoted from influential thinkers of the past. But the facts to which they refer are familiar in our everyday experience. Any observant person can note any day, both in himself and in others, the tendency to believe that which is in harmony with desire. We take that to be true which we should like to have so, and ideas that go contrary to our hopes and wishes have difficulty in getting lodgment. We all jump to conclusions; we all fail to examine and test our ideas because of our personal attitudes. When we generalize, we tend to make sweeping assertions; that is, from one or only a few facts we make a generalization covering a wide field. Observation also reveals the powerful influence wielded by social influences that have actually nothing to do with the truth or falsity of what is asserted and denied. Some of the dispositions that give these irrelevant influences power to limit and mislead thought are good in themselves, a fact that renders the need of training the more important. Reverence for parents and regard for those placed in authority are in the abstract surely valuable traits.

Yet, as Locke points out, they are among the chief forces that determine beliefs apart from and even contrary to the operations of intelligent thought. The desire to be in harmony with others is in itself a desirable trait. But it may lead a person too readily to fall in with the prejudices of others and may weaken his independence of judgment. It even leads to an extreme partisanship that regards it as disloyal to question the beliefs of a group to which one belongs.

Because of the importance of attitudes, ability to train thought is not achieved merely by knowledge of the best forms of thought. Possession of this information is no guarantee for ability to think well. Moreover, there are no set exercises in correct thinking whose repeated performance will cause one to be a good thinker. The information and the exercises are both of value. But no individual realizes their value except as he is personally animated by certain dominant attitudes in his own character. It was once almost universally believed that the mind had faculties, like memory and attention, that could be developed by repeated exercise, as gymnastic exercises are supposed to develop the muscles. This belief is now generally discredited in the large sense in which it was once held. Similarly it is highly questionable whether the practice of thinking in accordance with some logical formula results in creation of a general habit of thinking; namely, one applicable over a wide range of subjects. It is a matter of common notice that men who are expert thinkers in their own special fields adopt views on other matters without doing the inquiring that they know to be necessary for substantiating simpler facts that fall within their own specialities.

The Union of Attitude and Skilled Method

What can be done, however, is to cultivate those *attitudes* that are favorable to the use of the best methods of in-

quiry and testing. Knowledge of the methods alone will not suffice; there must be the desire, the will, to employ them. This desire is an affair of personal disposition. But on the other hand the disposition alone will not suffice. There must also be understanding of the forms and techniques that are the channels through which these attitudes operate to the best advantage. Since these forms and techniques will be taken up for discussion later, we shall here mention the attitudes that need to be cultivated in order to secure their adoption and use.

a. Open-mindedness. This attitude may be defined as freedom from prejudice, partisanship, and such other habits as close the mind and make it unwilling to consider new problems and entertain new ideas. But it is something more active and positive than these words suggest. It is very different from empty-mindedness. While it *is* hospitality to new themes, facts, ideas, questions, it is not the kind of hospitality that would be indicated by hanging out a sign: "Come right in; there is nobody at home." It includes an active desire to listen to more sides than one; to give heed to facts from whatever source they come; to give full attention to alternative possibilities; to recognize the possibility of error even in the beliefs that are dearest to us. Mental sluggishness is one great factor in closing the mind to new ideas. The path of least resistance and least trouble is a mental rut already made. It requires troublesome work to undertake the alteration of old beliefs. Self-conceit often regards it as a sign of weakness to admit that a belief to which we have once committed ourselves is wrong. We get so identified with an idea that it is literally a 'pet' notion and we rise to its defense and stop our mental eyes and ears to anything different. Unconscious fears also drive us into purely defensive attitudes that operate like a coat of armor not only to shut out new conceptions but even to prevent us

from making a new observation. The cumulative effect of these forces is to shut in the mind, and to create a withdrawal from new intellectual contacts that are needed for learning. They can best be fought by cultivating that alert curiosity and spontaneous outreaching for the new which is the essence of the open mind. The mind that is open merely in the sense that it passively permits things to trickle in and through will not be able to resist the factors that make for mental closure.

b. Whole-heartedness. When anyone is thoroughly interested in some object and cause, he throws himself into it; he does so, as we say, 'heartily,' or with a whole heart. The importance of this attitude or disposition is generally recognized in practical and moral affairs. But it is equally important in intellectual development. There is no greater enemy of effective thinking than divided interest. This division unfortunately is often produced in school. A pupil gives an external, perfunctory attention to the teacher and to his book and lesson while his inmost thoughts are concerned with matters more attractive to him. He pays attention with ear or eye, but his brain is occupied with affairs that make an immediate appeal. He feels obliged to study because he has to recite, to pass an examination, to make a grade, or because he wishes to please his teacher or his parents. But the material does not hold him by its own power. His approach is not straightforward and single-minded. This point may in some cases seem trivial. But in others it may be very serious. It then contributes to the formation of a general habit or attitude that is most unfavorable to good thinking.

When a person is absorbed, the subject carries him on. Questions occur to him spontaneously; a flood of suggestions pour in on him; further inquiries and readings are indicated and followed; instead of having to use his energy

to hold his mind to the subject (thereby lessening that which is available for the subject, itself, and creating a divided state of mind), the material holds and buoys his mind up and gives an onward impetus to thinking. A genuine enthusiasm is an attitude that operates as an intellectual force. A teacher who arouses such an enthusiasm in his pupils has done something that no amount of formalized method, no matter how correct, can accomplish.

c. *Responsibility.* Like sincerity or whole-heartedness, responsibility is usually conceived as a moral trait rather than as an intellectual resource. But it is an attitude that is necessary to win the adequate support of desire for new points of view and new ideas and of enthusiasm for and capacity for absorption in subject matter. These gifts may run wild, or at least they may lead the mind to spread out too far. They do not of themselves ensure that centralization, that unity, which is essential to good thinking. To be intellectually responsible is to consider the consequences of a projected step; it means to be willing to adopt these consequences when they follow reasonably from any position already taken. Intellectual responsibility secures integrity; that is to say, consistency and harmony in belief. It is not uncommon to see persons continue to accept beliefs whose logical consequences they refuse to acknowledge. They profess certain beliefs but are unwilling to commit themselves to the consequences that flow from them. The result is mental confusion. The 'split' inevitably reacts upon the mind to blur its insight and weaken its firmness of grasp; no one can use two inconsistent mental standards without losing some of his mental grip. When pupils study subjects that are too remote from their experience, that arouse no active curiosity, and that are beyond their power of understanding, they begin to use a measure of value and of reality for school subjects different from the measure

they employ for affairs of life that make a vital appeal. They tend to become intellectually irresponsible; they do not ask for the *meaning* of what they learn, in the sense of what difference it makes to the rest of their beliefs and to their actions.

The same thing happens when such a multitude of subjects or disconnected facts is forced upon the mind that the student does not have time and opportunity to weigh their meaning. He fancies he is accepting them, is believing them, when in fact his belief is of a totally different kind and implies a different measure of reality from that which operates in his life and action out of school. He then becomes mentally mixed; mixed not only about particular things but also about the basic reasons that make things worthy of belief. Fewer subjects and fewer facts and more responsibility for thinking the material of those subjects and facts through to realize what they involve would give better results. To carry something through to completion is the real meaning of thoroughness, and power to carry a thing through to its end or conclusion is dependent upon the existence of the attitude of intellectual responsibility.

The Bearing of These Personal Attitudes upon Readiness to Think

The three attitudes that have been mentioned, open-mindedness, whole-hearted or absorbed interest, responsibility in facing consequences, are of themselves personal qualities, traits of character. They are not the only attitudes that are important in order that the *habit* of thinking in a reflective way may be developed. But the other attitudes that might be set forth are also traits of character, attitudes that, in the proper sense of the word, are *moral*, since they are traits of personal character that have to be cultivated. Any person thinks at times on particular sub-

jects that arouse him. Other persons have habits of thinking quite persistently in special fields of interest; on matters, for example, that are their professional concern. A thoroughgoing habit of thinking is, however, more extended in its scope. No one can think about everything, to be sure; no one can think about *anything* without experience and information about it. Nevertheless, there is such a thing as *readiness* to consider in a thoughtful way the subjects that do come within the range of experience — a readiness that contrasts strongly with the disposition to pass judgment on the basis of mere custom, tradition, prejudice, etc., and thus shun the task of thinking. The personal attitudes that have been named are essential constituents of this general readiness.

If we were compelled to make a choice between these personal attitudes and knowledge about the principles of logical reasoning together with some degree of technical skill in manipulating special logical processes, we should decide for the former. Fortunately no such choice has to be made, because there is no opposition between personal attitudes and logical processes. We only need to bear in mind that, with respect to the aims of education, no separation can be made between impersonal, abstract principles of logic and moral qualities of character. What is needed is to weave them into unity.

CHAPTER THREE

NATIVE RESOURCES IN TRAINING THOUGHT

We have just discussed the values to be obtained by educating the mind in habits of thought and some of the obstacles that lie in the way of its development. But nothing can grow except from germs, from potentialities that tend to some development of themselves. There must be a native stock, or capital, of resources; we cannot force the power to think upon any creature that does not first think spontaneously, 'naturally,' as we say. But while we cannot learn or be taught to think, we do have to learn *how* to think well, especially *how* to acquire the general *habit* of reflecting. Since this habit grows out of original native tendencies, the teacher needs to know something about the nature of the primary capital stock that constitutes the germs out of which alone the habit is to be developed. Unless we know what there is to be laid hold of and used, we work in the dark and waste time and energy. We shall probably do something even worse, striving to impose some unnatural habit from without instead of directing native tendencies toward their own best fruition.

Teaching may be compared to selling commodities. No one can sell unless someone buys. We should ridicule a merchant who said that he had sold a great many goods although no one had bought any. But perhaps there are teachers who think that they have done a good day's teaching irrespective of what pupils have learned. There is the same

exact equation between teaching and learning that there is between selling and buying. The only way to increase the learning of pupils is to augment the quantity and quality of real teaching. Since learning is something that the pupil has to do himself and for himself, the initiative lies with the learner. The teacher is a guide and director; he steers the boat, but the energy that propels it must come from those who are learning. The more a teacher is aware of the past experiences of students, of their hopes, desires, chief interests, the better will he understand the forces at work that need to be directed and utilized for the formation of reflective habits. The number and quality of these factors vary from person to person. They cannot therefore be categorically enumerated in a book. But there are some tendencies and forces that operate in every normal individual, forces that must be appealed to and utilized if the best methods for the development of good habits of thought are to be employed.

I. Curiosity

Every living creature, while it is awake, is in constant interaction with its surroundings. It is engaged in a process of give and take, of doing something to objects around it and receiving back something from them — impressions, stimuli. This process of interacting constitutes the framework of experience. We are fitted out with devices that help us ward off destructive influences, devices that intercept harmful influences and protect us from them. But we also have tendencies that are forward-reaching and out-reaching, that go out to make new contacts, that seek new objects, that strive to vary old objects, that revel, as it were, in experiences for their own sake and so are ceaselessly active in enlarging the range of experience. These various tendencies are summed up in curiosity. Wordsworth's saying applies particularly to childhood:

The eye — it cannot choose but see;
We cannot bid the ear be still;
Our bodies feel, where'er they be,
Against or with our will.

All our sense and motor organs are, when we are awake, acting and being acted upon by something in the environment. With adults many of these contacts have been made; grown-ups permit themselves to become stale; they fall into ruts of experience and are contented with what happens in these ruts. To children the whole world is new; there is something thrilling to the healthy being in every new contact and it is eagerly sought for, not merely passively awaited and endured. There is no single faculty called 'curiosity'; every normal organ of sense and of motor activity is on the *qui vive*. It wants a chance to be active, and it needs some object in order to act. The sum total of these outgoing tendencies constitutes curiosity. It is the basic factor in enlargement of experience and therefore a prime ingredient in the germs that are to be developed into reflective thinking.

Three Stages, or Levels, of Curiosity

1. In the first manifestations, curiosity is far removed from thinking. It is a vital overflow, an expression of an abundant organic energy. A physiological uneasiness leads a child to get 'into everything,' — to be reaching, poking, pounding, prying. Observers of animals have noted what one author calls "their inveterate tendency to fool." "Rats run about, smell, dig, or gnaw, without real reference to the business in hand. In the same way Jack [a dog] scrambles and jumps, the kitten wanders and picks, the otter slips about everywhere like ground lightning, the elephant fumbles ceaselessly, the monkey pulls things about." [1] The most

[1] Hobhouse, *Mind in Evolution*, p. 195.

casual observation of the activities of a young child reveals a ceaseless display of exploring and testing activity. Objects are sucked, fingered, and thumped; drawn and pushed; handled and thrown; in short, they are experimented with until they cease to yield new qualities. Such activities are hardly intellectual, and yet without them intellectual activity would be feeble and intermittent through lack of stuff for its operations.

2. A higher stage of curiosity develops under the influence of social stimuli. When the child learns that he can appeal to others to eke out his store of experiences, so that, if objects fail to respond interestingly to his experiments, he may call upon persons to provide interesting material, a new epoch sets in. "What is that?" "Why?" become the unfailing signs of a child's presence. At first this questioning is hardly more than a projection into social relations of the physical overflow that earlier kept the child pushing and pulling, opening and shutting. He asks in succession what holds up the house, what holds up the soil that holds the house, what holds up the earth that holds the soil; but his questions are not evidence of any genuine consciousness of rational connections. His *why* is not a demand for scientific explanation; the motive behind it is simply eagerness for a larger acquaintance with the mysterious world in which he is placed. The search is not for a law or principle, but only for another, a bigger fact. Yet there is more than a desire to accumulate just information or heap up disconnected items — although sometimes the interrogating habit threatens to degenerate into a mere disease of language. In the feeling, however dim, that the facts which directly meet the senses are not the whole story, that there is more behind them and more to come from them, lies the germ of *intellectual* curiosity.

3. Curiosity rises above the organic and the social level

and becomes intellectual in the degree in which it is transformed into interest in finding out for oneself the answers to questions that are aroused by contact with persons and things. In what was just called the " social " stage, children are often more interested in the mere process of asking a question than they are in giving heed to the answer. At all events no particular question is attended to for very long; one asking succeeds another so fast that none is developed into a train of thought. Immediate asking and answering discharges curiosity. The crucial problem for the educator, whether parent or school teacher, is to utilize for *intellectual* purposes the organic curiosity of physical exploration and linguistic interrogation. This can be accomplished by attaching them to ends that are more remote, that require finding and inserting intermediate acts, objects, and ideas. To the degree that a distant end controls a sequence of inquiries and observations and binds them together as means to an end, just to that degree does curiosity assume a definitely intellectual character.

How Curiosity Is Lost

Unless transition to an intellectual plane is effected, curiosity degenerates or evaporates. Bacon's saying that we must become as little children in order to enter the kingdom of science is at once a reminder of the open-minded and flexible wonder of childhood and of the ease with which this endowment is lost. Some lose it in indifference or carelessness; others in a frivolous flippancy; many escape these evils only to become incased in a hard dogmatism that is equally fatal to the spirit of wonder. Some are so taken up with routine as to be inaccessible to new facts and problems. Others retain curiosity only with reference to what concerns their personal advantage in their chosen career. With many, curiosity is arrested on the plane of interest in local gossip

and in the fortunes of their neighbors; indeed, so usual is this result that very often the first association with the word *curiosity* is a prying inquisitiveness into other people's business. With respect, then, to curiosity, the teacher has usually more to learn than to teach. Rarely can he aspire to the office of kindling or even of increasing it; his province is rather to provide the materials and the conditions by which organic curiosity will be directed into investigations that have an aim and that produce results in the way of increase of knowledge, and by which social inquisitiveness will be converted into ability to find out things known to others, an ability to ask questions of books as well as of persons. The teacher has to protect the growing person from those conditions which occasion a mere succession of excitements which have no cumulative effect, and which, therefore, make an individual either a lover of sensations and sensationalism or leave him blasé and uninterested. He has to avoid all dogmatism in instruction, for such a course gradually but surely creates the impression that everything important is already settled and nothing remains to be found out. He has to know how to give information when curiosity has created an appetite that seeks to be fed, and how to abstain from giving information when, because of lack of a questioning attitude, it would be a burden and would dull the sharp edge of the inquiring spirit.

II. Suggestion

Ideas Occur Spontaneously

Many a child, as noted earlier, has tried to see whether he could not stop 'thinking,' whether he could not arrest the flow of ideas passing through his head. But 'thoughts,' of this rudimentary and uncontrolled sort, spring into being quite

as surely as "our bodies feel, where'er they be, against or with our will." We cannot make ourselves have ideas or not have them any more than we can directly make ourselves have sensations from things. In the one case as in the other, we can put ourselves or be put by others into situations where we are likely to have sensations and ideas in worthwhile ways, in ways that lead on to something else and so insure that the person be developed and recreated by them and not be exhausted by the mere having of them.

What a Suggestion Is

Ideas, in this primitive and spontaneous sense, are *suggestions*. Nothing in experience is absolutely simple, single, and isolated. Everything experienced comes to us along with some other object, quality, or event. Some object is focal and most distinct, but it shades off into other things. A child may be absorbed in watching a bird; for the bright center of his consciousness there is nothing but the bird there. But of course it is somewhere — on the ground, in a tree. And the actual experience includes much more. The bird also is doing something — flying, pecking, feeding, singing, etc. And the experience of the bird is itself complex, not a single sensation; there are numbers of related qualities included within it. This highly elementary illustration indicates why it is that the next time a child sees a bird, he will 'think' of something else that is not then present. That is to say, that portion of his present experience which is like that of prior experience will call up or *suggest* some thing or quality connected with it which was present in the total previous experience; that thing or quality in turn may suggest something connected with itself; it not only *may* do so, but it *will* do so unless some new object of perception starts another train of suggestions going. In this primary sense, then, the having of ideas is not so much

something we do, as it is something that happens to us. Just as, when we open our eyes, we see what is there; so, when suggestions occur to us, they come to us as functions of our past experience and not of our present will and intention. So far as thoughts in this particular meaning are concerned, it is true to say "it thinks" (as we say "it rains"), rather than "I think." Only when a person tries to get control of the *conditions* that determine the occurrence of a suggestion, and only when he accepts responsibility for using the suggestion to see what follows from it, is it significant to introduce the 'I' as the agent and source of thought.

The Dimensions of Suggestion

Suggestion has a variety of aspects (or 'dimensions,' as we may term them), varying in different persons, both in themselves and in their mode of combination. These dimensions are (*a*) ease, or promptness; (*b*) range, or variety; and (*c*) depth, or profundity.

a. Ease, or Promptness. The common classification of persons into the dull and the bright is made primarily on the basis of the readiness or facility with which suggestions follow upon the presentation of objects and upon the happening of events. As the metaphor of 'dull' and 'bright' implies, some minds are impervious, or else they absorb passively. Everything presented is lost in a drab monotony that gives nothing back. But others reflect, or give back in varied lights, all that strikes upon them. The dull make no response; the bright flash back the fact with an added quality. An inert or stupid mind requires a heavy jolt or an intense shock to move it to suggestion; the bright mind is quick, is alert, to react with interpretation and suggestion of consequences to follow.

Yet the teacher is not entitled to assume stupidity or even dullness merely because of unresponsiveness to school sub-

jects or to a lesson as presented by textbook or teacher. The pupil labeled 'hopeless' may react in quick and lively fashion when the thing-in-hand seems to him worth while, as some out-of-school sport or social affair. Indeed, even the school subject might move him, were it set in a different context and treated by a different method. A boy dull in geometry may prove quick enough when he takes up the subject in connection with manual training; the girl who seems inaccessible to historical facts may respond promptly when it is a question of judging the character and deeds of people of her acquaintance or of fiction. Barring physical defect or impaired health, slowness and dullness in *all* directions are comparatively rare. Moreover, slowness of response is not necessarily dullness; a thoughtful person waits to think things over.

b. Range, or Variety. Irrespective of the difference in persons as to the ease and promptness with which they respond to facts, there is a difference in the number or range of the suggestions that occur. We speak truly, in some cases, of the 'flood' of suggestions; in others, there is but a slender 'trickle.' Occasionally, slowness of outward response is due to a great variety of suggestions that check one another and lead to hesitation and suspense, while a lively and prompt suggestion may take such possession of the mind as to preclude the development of others. Too few suggestions indicate a dry and meager mental habit; when this is joined to great learning, the result is a pedant or a Gradgrind. Such a person's mind rings hard; he is likely to bore others with mere bulk of information. He contrasts with the person whom we call 'ripe,' 'juicy,' and 'mellow.'

A conclusion reached after consideration of a few alternatives may be formally correct, but it will not possess the fullness and richness of meaning of one arrived at after comparison of a greater variety of alternative suggestions. On

the other hand, suggestions may be too numerous and too varied to secure the best discipline and development of mental habit. So many suggestions arise that the person is at a loss to select among them. He finds it difficult to reach any definite conclusion and wanders more or less helplessly among them. So much suggests itself *pro* and *con*, one thing leads on to another so naturally, that he finds it difficult to decide in practical affairs or to conclude in matters of theory. There is such a thing as too much thinking, as when action is paralyzed by the multiplicity of views suggested by a situation. Or again, the very number of suggestions may be hostile to tracing logical sequences among them, for it may tempt the mind away from the necessary but trying task of search for real connections, into the more congenial occupation of embroidering upon the given facts a tissue of agreeable fancies. The best mental habit involves a balance between paucity and superfluity of suggestions.

c. Depth, or Profundity. We distinguish between people not only upon the basis of the quickness and variety of their intellectual response, but also with respect to the plane upon which these occur — the intrinsic quality of their response.

One man's thought is profound, while another's is superficial; one goes to the roots of the matter, and another touches lightly its most external aspects. This phase of thinking is perhaps the most untaught of all, and the least amenable to external influence whether for improvement or harm. Nevertheless, the conditions of the pupil's contact with subject matter may be such that he is compelled to come to quarters with its more significant features or such that he is encouraged to deal with it upon the basis of what is trivial. The common assumptions that, if the pupil only thinks, one thought is just as good for his mental discipline as another, and that the end of study is the amassing of

information — both of them tend to foster superficial, at the expense of significant, thought. Pupils who in matters of practical experience have a ready and acute perception of the difference between the significant and the meaningless often reach in school subjects a point where all things seem equally important or equally unimportant; where one thing is just as likely to be true as another; and where intellectual effort is expended, not in discriminating between things, but in trying to make verbal connections between words.

Depth and Slowness. Sometimes slowness and depth of response are intimately connected. Time is required in order to digest impressions, and translate them into substantial ideas. 'Brightness' may be but a flash in the pan. The 'slow but sure' person, whether man or child, is one in whom impressions sink and accumulate, so that thinking is done at a deeper level of value than by those with a lighter load. Many a child is rebuked for slowness, for not answering promptly, when his forces are taking time to gather themselves together to deal effectively with the problem at hand. In such cases, failure to afford time and leisure encourages, if it does not actually create, habits of speedy, but snapshot and superficial, judgment. The depth to which a sense of the problem, of the difficulty, sinks, determines the quality of the thinking that follows; and any habit of teaching that encourages the pupil for the sake of a successful recitation or of a display of memorized information to glide over the thin ice of genuine problems reverses the true method of mind-training.

It is profitable to study the lives of men and women who achieve in adult life fine things in their respective callings, but who were called dull in their school days. Sometimes the early wrong judgment was due mainly to the fact that the direction in which the child showed his ability was not one recognized by the good old standards in use, as in

the case of Darwin's interest in beetles, snakes, and frogs. Sometimes it was due to the fact that the child dwelt habitually on a deeper plane of reflection than other pupils — or than his teachers — and so did not show to advantage when prompt answers of the usual sort were expected. Sometimes it was due to the fact that the pupil's natural mode of approach clashed habitually with that of the text or teacher, and the methods of the latter were assumed to be the absolute basis of estimate.

Thinking Is Specific and Any Subject May Be Intellectual

In any event, it is desirable that the teacher should rid himself of the notion that 'thinking' is a single, unalterable faculty; that he should recognize that it is a term denoting the various ways in which things acquire significance for the individual; and that individuals differ. It is desirable to expel also the kindred notion that some subjects are inherently 'intellectual,' and hence possessed of an almost magical power to train the faculty of thought. Thinking is specific, not a machinelike, ready-made apparatus to be turned indifferently and at will upon all subjects, as a lantern throws its light as may happen upon horses, streets, gardens, trees, or river. Thinking is specific, in that different things suggest their own appropriate meanings, tell their own unique stories, and do this in very different ways with different persons. As the growth of the body is through the assimilation of food, so the growth of the mind is through the logical organization of subject matter. Thinking is not like a sausage machine that reduces all materials indifferently to one stereotyped, marketable commodity, but is the power of following up and linking together the specific suggestions that specific things arouse. Accordingly, any subject, from Greek to cooking, and from drawing to mathematics, is intellectual, if intellectual at all, not in its fixed

inner structure, but in its function — in its power to start and direct significant inquiry and reflection. What geometry does for one, the manipulation of laboratory apparatus, the mastery of a musical composition, or the conduct of a business affair, does for another.

III. Orderliness

Reflective Thinking Implies Consecutiveness, Continuity, or Ordering of Suggestions

The mere occurrence of ideas or suggestions constitutes thinking, but not reflective thinking, not observation and thought directed to an acceptable conclusion — that is, to a conclusion which it is reasonable to believe because of the grounds on which it rests and the evidence which supports it. Ideas merely as such, apart from their orderly sequence, just 'pop into our heads.' "I just *happened* to think of something" is often a perfectly accurate statement. Another dimension is needed, accordingly, to transform suggestions into reflective thinking — the property of order, of consecutiveness. There is no thinking without what is called 'association of ideas,' or a train of suggestions. But such a train, of itself, does not constitute reflection. Only when the succession is so controlled that it is an orderly sequence leading up to a conclusion that contains the intellectual force of the preceding ideas, do we have reflective thought. And by "intellectual force" is signified force in making some idea worthy of belief; in making it *trust*worthy.

When the factors of facility, of fertility, and of depth are properly balanced or proportioned, we get as the outcome continuity of thought. We desire neither the slow mind nor yet the hasty. We wish neither random diffuseness

nor fixed rigidity. Consecutiveness means flexibility and variety of materials, conjoined with singleness and definiteness of direction. It is opposed both to a mechanical routine uniformity and to a grasshopper-like movement. Of one kind of bright children, teachers often say that "they might do anything, if only they settled down," so quick and apt are they in a variety of responses. But, alas, they do not always settle.

On the other hand, it is not enough *not* to be diverted. A deadly and fanatic consistency is not our goal. Concentration does not mean fixity, or a cramped arrest or paralysis of the flow of suggestion. It means variety and change of ideas combined into a *single steady trend moving toward a unified conclusion.* Thoughts are concentrated, not by being kept still and quiescent, but by being kept moving toward an object, as a general marshals his troops for attack or defense. Holding the mind to a subject is like holding a ship to its course; it implies constant change of position combined with unity of direction. Consistent and orderly thinking is precisely the achieving of such a change *within* a given subject matter. Consistency is no more the mere absence of contradiction than concentration is the mere absence of diversion — which exists in dull routine or in a person 'fast asleep.' All kinds of varied and incompatible suggestions may sprout and be followed in their growth, and yet thinking be consistent and orderly, provided each one of the suggestions is viewed in relation to the main topic and the main end to be attained.

Ordering of Thought Often the Indirect Concomitant of Ordering of Action

In the main, for most persons, the primary resource in the development of orderly habits of thought is indirect, not direct. Intellectual organization originates and for a time

grows as an accompaniment of the organization of the means required to realize an end, not as the result of a direct appeal to thinking power. The need of thinking to accomplish something beyond thinking is more potent than thinking for its own sake. All people at the outset, and the majority of people probably all their lives, attain to some ordering of thought through ordering of action. Adults normally carry on some occupation, profession, pursuit; and this furnishes the stabilizing axis about which their knowledge, their beliefs, and their habits of reaching and testing conclusions are organized. Observations that have to do with the efficient performance of their calling are extended and rendered precise. Information related to it is not merely amassed and then left in a heap; it is classified and subdivided so as to be available as needed. Inferences are made by most men not from purely speculative motives, but because they are necessary for the efficient performance of the duties involved in their several callings. Thus their inferences are constantly tested by results achieved; futile and scattering methods tend to be discounted; orderly arrangements have a premium put upon them. The event, the issue, stands as a constant check on the thinking that has led up to it; and this discipline by efficiency in action is the chief sanction, in practically all who are not scientific specialists, of orderliness of thought — provided always that action remains intelligent and does not become routine.

Peculiar Difficulty and Peculiar Opportunity with Children

Such a resource — the main prop of disciplined thinking in adult life — is not to be despised in training the young in right intellectual habits. From an early age, children have to select acts and objects as means for reaching ends. With selection go arrangement and adaptation. These operations demand *judgment*. Suitable conditions work unconsciously

to build up an attitude favorable to reflective operations. There are, however, profound differences between the immature and the adult with respect to the organized character of their activities — differences that must be taken seriously into account in any educational use of activities: (1) the external achievement resulting from activity is a more urgent necessity with the adult, and hence is with him a more effective means of disciplining the mind than with the child; (2) the ends of adult activity are more specialized than those of child activity.

1. The selection and arrangement of appropriate lines of action is a much more difficult problem with youth than it is in the case of adults. With the latter, the main lines are more or less settled by circumstances. The social status of the adult — the fact that he is a citizen, a householder, a parent, one occupied in some regular industrial or professional calling — prescribes the chief features of the acts to be performed, and secures, almost automatically as it were, appropriate and related modes of thinking. But with the child there is no such fixity of status and pursuit. There is almost nothing to dictate that such and such a consecutive line of action, rather than another, shall be followed; while the will of others, his own caprice, and circumstances about him tend to produce an isolated momentary act. The absence of continued motivation coöperates with the inner plasticity of the immature to increase the importance of educational training and at the same time magnifies the difficulties in the way of finding consecutive modes of activities that may do for child and youth what serious vocations and functions do for the adult. In the case of children the choice is so peculiarly exposed to arbitrary factors, to mere school traditions, to waves of pedagogical fad and fancy, to fluctuating social cross currents, that sometimes, in sheer disgust at the inadequacy of results, a reaction oc-

curs in favor of abandoning altogether the use of overt activity as an educational factor, and recourse is had to purely theoretical subjects and methods.

2. This very difficulty, however, points to the fact that the *opportunity for selecting truly educative activities* is indefinitely greater in child life than in adult. The factor of external pressure is so strong with most adults that the educative value of the pursuit — its reflex influence upon intelligence and character — however genuine, is incidental, and frequently almost accidental. The problem and the opportunity with the young is selection of orderly and continuous modes of occupation, which, while they lead up to and prepare for the indispensable activities of adult life, have their own *sufficient justification in their present reflex influence upon the formation of habits of thought.*

Extreme Views about Overt Activities in Education

Educational practice shows a continual tendency to oscillate between two extremes with respect to overt and exertive activities.

One extreme is to neglect them almost entirely, on the ground that they are chaotic and fluctuating, mere diversions appealing to the transitory unformed taste and caprice of immature minds; or if they avoid this evil, are objectionable copies of the highly specialized, and more or less commercial, activities of adult life. If activities are admitted at all into the school, the admission is a grudging concession to the necessity of having occasional relief from the strain of constant intellectual work or to the clamor of outside utilitarian demands upon the school.

The other extreme is an enthusiastic belief in the almost magical educative efficacy of any kind of activity, granted it is an activity and not a passive absorption of academic and theoretic material. The conceptions of play, of self-

expression, of natural growth, are appealed to almost as if they meant that almost any kind of spontaneous activity inevitably secures the desired or desirable training of mental power; or a mythological brain physiology is appealed to as proof that any exercise of the muscles trains power of thought.

The Real Problem: Discovering the Valuable Occupations

While we vibrate from one of these extremes to the other, the most serious of all problems is ignored: the problem, namely, of discovering and arranging the occupations (*a*) that are most congenial, best adapted, to the immature stage of development; (*b*) that have the most ulterior promise as preparation for the social responsibilities of adult life; and (*c*) that, *at the same time*, have the maximum of influence in forming habits of acute observation and of consecutive inference. As curiosity is related to the acquisition of material of thought, as suggestion is related to flexibility and force of thought, so the ordering of activities, not themselves primarily intellectual, is related to the forming of intellectual powers of consecutiveness.

IV. Some Educational Conclusions

The wisest of the Greeks said that wonder was the author of science and philosophy. Wonder is not identical with curiosity; it is, however, the same as curiosity when the latter reaches the intellectual plane. External monotony and internal routine are the worst enemies of wonder. Surprise, the unexpected, novelty, stimulate it. Everyone knows that a moving object catches and holds the eye more readily than one at rest, and the more mobile parts of the body have the greater capacity for making tactile discriminations than

those that are more fixed. Yet under the name of discipline and good order, school conditions are often made to approximate as nearly as possible to monotony and uniformity. Desks and chairs are in set positions; pupils are regimented with military precision. The same textbook is thumbed for a long period to the exclusion of other reading. All topics are barred from the recitation except those taken up in the text; 'system' in the conduct of the recitation is so emphasized that spontaneity is excluded and likewise novelty and variety. These instances may seem exaggerated with respect to the administration of the better schools. But in schools where the chief aim is to establish mechanical habit and instill uniformity of conduct, the conditions that stimulate wonder and keep it energetic and vital are necessarily ruled out.

Unfortunately, reaction against this mechanical administration of education is often *merely* a reaction. Novelty is treated as if it were an end in itself, when in fact it is simply a stimulating occasion for the exercise of observation and inquiry. Variety is carried to the point where it is incompatible with that continuity that is essential for good thinking. Because order has been associated with external uniformity, the kind of order that promotes effective intellectual action is also slighted. Again, most enterprises in school are of too short a span to allow for that unfolding and leading of one thing into another without which good habits of reflection cannot be developed. In the desire for accuracy in remembering details, large and comprehensive views are shut out. The acquisition of information is identified with the amassing of isolated items, and not with assimilating mental food that is to be organized into thought if it is to have any value. It is an old saying that unity in variety marks every work of genuine art. Certainly the art of teaching bears out the saying. If one re-

calls his contacts with teachers who left a permanent intellectual impress, one will find that, although they may have violated in their teaching many of the set rules of pedagogy, they were persons who could maintain continuity of thought and effort even when admitting what seemed to be diversions and forays into side fields; that they were persons who introduced novelty and variety to keep attention alert and taut, but who also utilized these factors to contribute to the building up of the main problem and the enrichment of the main theme.

CHAPTER FOUR

SCHOOL CONDITIONS AND THE TRAINING OF THOUGHT

I. Introductory: Methods and Conditions

Formal Discipline *versus* Real Thinking

The so-called 'faculty psychology' went hand in hand with the vogue of the formal-discipline idea in education. If thought is a distinct piece of mental machinery, separate from observation, memory, imagination, and common-sense judgments of persons and things, then thought should be trained by special exercises designed for the purpose, as one might devise special exercises for developing the biceps muscles. Certain subjects are then to be regarded as intellectual or logical subjects *par excellence*, possessed of a predestined fitness to exercise the thought faculty, just as certain machines are better than others for developing arm power. With these three notions goes the fourth, that method consists of a set of operations by which the machinery of thought is set going and kept at work upon any subject matter.

We have tried to make it clear in the previous chapters that there is no single and uniform power of thought, but a multitude of different ways in which specific things — things observed, remembered, heard of, read about — evoke suggestions or ideas that are pertinent to a problem or question and that carry the mind forward to a justifiable conclusion. Training is that development of curiosity, suggestion, and habits of exploring and testing, which increases

sensitiveness to questions and love of inquiry into the puzzling and unknown; which enhances the fitness of suggestions that spring up in the mind, and controls their succession in a developing and cumulative order; which makes more acute the sense of the force, the *proving* power, of every fact observed and suggestion employed. Thinking is not a separate mental process; it is an affair of the *way* in which the vast multitude of objects that are observed and suggested are employed, the way they run together and are *made* to run together, the way they are handled. Consequently any subject, topic, question, is intellectual not *per se* but because of the part it is made to play in directing thought in the life of any particular person.

The Training of Thought Is Indirect

For these reasons, the problem of *method* in forming habits of reflective thought is the problem of establishing *conditions* that will arouse and guide *curiosity*; of setting up the connections in things experienced that will on later occasions promote the flow of *suggestions*, create problems and purposes that will favor *consecutiveness* in the succession of ideas. These topics will be considered more at length later, but an illustration or two drawn from failure to secure proper conditions will indicate more clearly what is meant. Children are hushed up when they ask questions; their exploring and investigating activities are inconvenient and hence they are treated like nuisances; pupils are taught to memorize things so that merely one-track verbal associations are set up instead of varied and flexible connections with things themselves; no plans and projects are provided that compel the student to look ahead and foresee and in the execution of which the accomplishment of one thing sets up new questions and suggests new undertakings. The teacher may devise special exercises intended to train think-

ing directly, but when these wrong conditions exist, special exercises are doomed to be futile. The training of thought can be attained only by regulating the causes that evoke and guide it.

With respect to the training of habits of thought, the teacher's problem is thus twofold. On the one side, he needs (as we saw in the last chapter) to be a student of individual traits and habits; on the other side, he needs to be a student of the conditions that modify for better or worse the directions in which individual powers habitually express themselves. He needs to recognize that method covers not only what he intentionally devises and employs for the purpose of mental training, but also what he does without any conscious reference to it — anything in the atmosphere and conduct of the school that reacts in any way upon the curiosity, the responsiveness, and the orderly activity of children. The teacher who is an intelligent student both of individual mental operations and of the effects of school conditions upon those operations can largely be trusted to select for himself methods of instruction in their narrower and more technical sense — those best adapted to achieve results in particular subjects, such as reading, geography, or algebra. In the hands of one who is not intelligently aware of individual capacities and of the influence unconsciously exerted upon them by the entire environment, even the best of technical methods are likely to get an immediate result at the expense of forming deep-seated and persistent *bad* habits.

Generic and Specific Conditions

There is always a temptation for the teacher to keep attention fixed upon a limited field of the pupil's activity. Is the student progressing in the particular topic in arithmetic, history, geography, etc., that is under consideration? When

the teacher fixes his attention exclusively on such matters as these, the process of forming underlying and permanent habits, attitudes, and interests is overlooked. Yet the formation of the latter is the more important for the future. The other side of this fact is that the teacher, while fixing attention upon the *specific* conditions that seem to affect learning of the immediate lesson before the class, ignores the more general conditions that influence the creation of permanent attitudes, especially the traits of character, open-mindedness, whole-heartedness, and responsibility, mentioned in an earlier chapter. Postponing consideration of special points, we shall, accordingly, in the present chapter take up some of the more generic conditions of the schoolroom that affect the development of effective mental habits.

II. The Influence of the Habits of Others

Bare reference to the imitativeness of human nature is enough to suggest how profoundly the mental habits of others affect the attitude of the one being trained. Example is more potent than precept, and a teacher's best conscious efforts may be more than counteracted by the influence of personal traits that he is unaware of or that he regards as unimportant. Methods of instruction and discipline that are technically faulty may be rendered practically innocuous by the inspiration of the personal method that lies back of them.

The Teacher a Stimulus to Response in Intellectual Matters

To confine, however, the conditioning influence of the educator, whether parent or teacher, to imitation is to get a very superficial view of the intellectual influence of others.

Imitation is but one case of a deeper principle — that of stimulus and response. *Everything the teacher does, as well as the manner in which he does it, incites the child to respond in some way or other, and each response tends to set the child's attitude in some way or other.* Even the inattention of the child to the adult is often a response that is the result of unconscious training.[1] The teacher is rarely (and even then never entirely) a transparent medium of the access of another mind to a subject. With the young, the influence of the teacher's personality is intimately fused with that of the subject; the child does not separate or even distinguish the two. And as the child's response is *toward* or *away from* anything presented, he keeps up a running commentary, of which he himself is hardly distinctly aware, of like and dislike, of sympathy and aversion, not merely upon the acts of the teacher, but also upon the subject with which the teacher is occupied.

The extent and power of this influence upon morals and manners, upon character, upon habits of speech and social bearing, are almost universally recognized. But the tendency to conceive of thought as an isolated faculty often blinds teachers to the fact that this influence is just as real and pervasive in intellectual concerns. Teachers, as well as children, stick more or less to the main points, have more or less wooden and rigid methods of response, and display more or less intellectual curiosity about matters that come up. And every trait of this kind is an inevitable part of the teacher's method of teaching. Merely to accept without notice slipshod habits of speech, slovenly inferences, unimaginative and literal response, is to indorse these tend-

[1] A child of four or five who had been repeatedly called to the house by his mother with no apparent response on his own part, was asked if he did not hear her. He replied quite judicially, "Oh, yes, but she doesn't call very mad yet."

marked — 'disciplinary' studies, such as arithmetic and formal grammar.[8] Each of these groups of subjects has its own special pitfalls.

Disciplinary Studies Liable to Lose Contact with the Practical

In the case of the so-called disciplinary or preëminently logical studies, there is danger of the isolation of intellectual activity from the ordinary affairs of life. Teacher and student alike tend to set up a chasm between logical thought, as something abstract and remote, and the specific and concrete demands of everyday events. The abstract tends to become so aloof, so far away from application, as to be cut loose from practical and moral bearing. The gullibility of specialized scholars when out of their own lines, their extravagant habits of inference and speech, their ineptness in reaching conclusions in practical matters, their egotistical engrossment in their own subjects, are extreme examples of the bad effects of severing studies completely from their ordinary connections in life.

Skill Studies Liable to Become Purely Mechanical

The danger in those studies where the main emphasis is upon acquisition of skill is just the reverse. The tendency is to take the shortest cuts possible to gain the required end. This makes the subjects *mechanical*, and thus restrictive of intellectual power. In the mastery of reading, writing, drawing, laboratory technique, etc., the need for economy of time and material, of neatness and accuracy, for promptness and uniformity, is so great that these things tend to become ends in themselves, irrespective of their in-

[8] Of course, any one subject has all three aspects; *e.g.*, in arithmetic, counting, reading and writing numbers, rapid adding, etc., are cases of skill in doing; the tables of weights and measures are a matter of information, etc.

fluence upon general mental attitude. Sheer imitation, dictation of steps to be taken, mechanical drill, may give results most quickly and yet strengthen traits likely to be fatal to reflective power. The pupil is enjoined to do this and that specific thing, with no knowledge of any reason except that by so doing he gets his result most speedily; his mistakes are pointed out and corrected for him; he is kept at pure repetition of certain acts till they become automatic. Later, teachers wonder why the pupil reads with so little expression, and figures with so little intelligent consideration of the terms of his problem. In some educational dogmas and practices, the very idea of training the mind seems to be hopelessly confused with that of a drill which hardly touches *mind* at all — or touches it for the worse — since it is wholly taken up with training skill in external execution. This method reduces the 'training' of human beings to the level of animal training. Practical skill, modes of effective technique, can be intelligently, non-mechanically *used* only when intelligence has played a part in their *acquisition*.

Informational Studies May Fail to Develop Wisdom

A false opposition is often set up also, especially in higher education, between information and understanding. One party insists that the acquisition of scholarship must come first, since intelligence can operate only on the basis of actual subject matter that is under control. The other party holds that scholarship for and by itself is at best an end only for the specialist, the graduate student, etc., and that the development of power to think is the chief thing. The real desideratum is getting command of scholarship — or skill — under conditions that *at the same time* exercise thought. The distinction between information and wisdom is old, and yet requires constantly to be redrawn. Informa-

tion is knowledge that is merely acquired and stored up; wisdom is knowledge operating in the direction of powers to the better living of life. Information, merely as information, implies no special training of intellectual capacity; wisdom is the finest fruit of that training. In school, amassing information always tends to escape from the ideal of wisdom or good judgment. The aim often seems to be — especially in such a subject as geography — to make the pupil 'what has been called a ' cyclopedia of useless information.' ' Covering the ground ' is the primary necessity; the nurture of mind a bad second. Thinking cannot, of course, go on in a vacuum; suggestions and inferences can occur only to a mind that possesses information as to matters of fact.

But there is all the difference in the world whether the acquisition of information is treated as an end in itself, or is made an integral portion of the training of thought. The assumption that information that has been accumulated apart from use in the recognition and solution of a problem may later on be, at will, freely employed by thought is quite false. The skill at the ready command of intelligence is the skill acquired with the aid of intelligence; the only information which, otherwise than by accident, can be put to logical use is that acquired in the course of thinking. Because their knowledge has been achieved in connection with the needs of specific situations, men of little book-learning are often able to put to effective use every ounce of knowledge they possess; while men of vast erudition are often swamped by the mere bulk of their learning, because memory, rather than thinking, has been operative in obtaining it.

IV. The Influence of Current Aims and Ideals

It is, of course, impossible to separate this somewhat intangible condition from the points just dealt with; for auto-

matic skill and quantity of information are educational ideals that pervade the whole school. We may distinguish, however, certain tendencies, such as that of judging education from the standpoint of external results, instead of from that of the development of personal attitudes and habits. The ideal of the *product*, as against that of the mental *process* by which the product is attained, shows itself both in instruction and in moral discipline.

The Exaltation of External Standards

a. In Instruction. In instruction, the external standard manifests itself in the importance attached to the 'correct answer.' No one other thing, probably, works so fatally against focussing the attention of teachers upon the training of mind as the domination of *their* minds by the idea that the chief thing is to get pupils to recite their lessons correctly. As long as this end is uppermost (whether consciously or unconsciously), training of mind remains an incidental and secondary consideration. There is no great difficulty in understanding why this ideal has such vogue. The large number of pupils to be dealt with and the tendency of parents and school authorities to demand speedy and tangible evidence of progress conspire to give it authority. Knowledge of subject matter — not of children — is alone exacted of teachers by this aim; and moreover, knowledge of subject matter only in portions definitely prescribed and laid out, and hence mastered with comparative ease. Education that takes as its standard the improvement of the intellectual attitude and method of students demands more serious preparatory training, for it exacts sympathetic and intelligent insight into the workings of individual minds and a very wide and flexible command of subject matter — so as to be able to select and apply just what is needed when it is needed. Finally, the securing of external results is an

aim that lends itself naturally to the mechanics of school administration — to examinations, marks, gradings, promotions, and so on.

b. In Behavior. With reference to behavior also, the external ideal has a great influence. Conformity of acts to precepts and rules is the easiest, because most mechanical, standard to employ. It is no part of our present task to tell just how far dogmatic instruction, or strict adherence to custom, convention, and the commands of a social superior, should extend in moral training; but since problems of conduct are the deepest and most common of all the problems of life, the ways in which they are met have an influence that radiates into every other mental attitude, even those far remote from any direct or conscious moral consideration. Indeed, the *deepest plane of the mental attitude of everyone is fixed by the way in which problems of behavior are treated.* If the function of thought, of serious inquiry and reflection, is reduced to a minimum in dealing with them, it is not reasonable to expect habits of thought to exercise great influence in less important matters. On the other hand, habits of active inquiry and careful deliberation in the significant and vital problems of conduct afford the best guarantee that the general structure of mind will be reasonable.

Is There Transfer of Training in Thinking?

The point just made leads to the question that is sometimes raised as to whether the rejection of the idea of special faculties that can be trained by formal exercises does not demand the rejection also of the possibility of training thought. The question has been partly answered in the conception of the nature of thinking that has been set forth (that it is not a 'faculty,' but an organization of materials and activities) and its relation to objective conditions. But there is another aspect of the question that is suggested by

the term 'transfer.' The question is asked whether the ability to think gained in dealing with one situation or subject will prove itself equally efficient in dealing with another subject and situation; that it does not do so necessarily is indicated by the fact that a scientific specialist may be a child in practical affairs of business; that he may violate in matters of politics or religious belief every principle that he scrupulously observes in his special field of inquiry. It is now generally recognized that common elements are the basis of so-called 'transfer.' That is, the carrying over of skill and understanding from one experience to another is dependent upon the existence of like elements in both experiences. The simplest sort of example is found in the extended application given by children to ideas and words. A young child whose acquaintance with quadrupeds is limited to a dog will tend to call any four-footed animal of a similar size "doggie." Similar qualities are always the bridge over which the mind passes in going from a former experience to a new one. Now thinking, as we shall see later in detail, is a process of *grasping in a conscious way* the common elements. It thus adds greatly to the availability of common elements for purposes of transfer. Unless these elements are seized and held by the mind (as they are in a rudimentary way by the symbol 'dog'), any transfer occurs only blindly, by sheer accident. The first answer to the objection that the building up of a general habit of thinking is impossible is, therefore, that thinking is precisely the factor that makes transfer possible and that brings it under control.

The more technical a subject, the fewer common elements it provides for thinking to work with. In fact, we might almost set up this test for the technical nature of any subject, theme, or undertaking: in what degree is it isolated from the material of everyday experiences because of absence of

elements common to both? To the person just beginning algebra and physics, the ideas of 'exponent' and 'atom' are technical; they stand alone. He is not aware of these meanings in connection with the objects and acts of his ordinary experience; they do not seem to be contained in even the materials of his school experience. To the mature scientist, on the contrary, the ideas are much less technical because they enter into so many experiences that have become familiar to him as a scientific inquirer. During the early stages of experience and for the greater part of *all* experience, save that of specialists, the common elements are the *human* elements, those connected with the relations of persons to one another and to groups. The most important things to a child are his connections with father and mother, brother and sister. Elements connected with them recur in most of the experiences he has. They saturate the greater number of his experiences and supply them with their meaning. These human and social factors are accordingly those that carry over and can be carried over most readily from one experience to another. They furnish the material best suited for developing generalized abilities of thinking. One reason why much of elementary schooling is so useless for the development of reflective attitudes is that, on entering school life, a break is suddenly made in the life of the child, a break with those of his experiences that are saturated with social values and qualities. Schooling is then technical because of its isolation, and the child's thinking cannot operate because school has nothing in common with his earlier experiences.

PART TWO

LOGICAL CONSIDERATIONS

CHAPTER FIVE

THE PROCESS AND PRODUCT OF REFLECTIVE ACTIVITY: PSYCHOLOGICAL PROCESS AND LOGICAL FORM

I. Thinking as a Formal and as an Actual Occurrence

The Logic of the Textbooks

When you look into a treatise on Logic, you find in it a classification of terms, such as particular, general, denotative, connotative, etc.; of propositions, such as positive, negative, universal, particular; and of arguments in the form of syllogisms. A familiar example of the latter is: All men are mortal; Socrates is a man; therefore, Socrates is mortal. It is characteristic of a formal statement that particular specific objects may be eliminated and a blank substituted which may be filled in with any material. The form of the syllogism just cited is: All M (human beings in this case) is P; all S is M; therefore, all S is P. In the formulation S stands for the subject of the conclusion, P for its predicate, and M for the *middle* term. The middle term appears in both premises and is the connecting link by which S and P, otherwise logically disconnected, are locked into unity. It is the ground and justification of the assertion at the close that S is P. In invalid reasonings the middle term fails to bind together tightly and exclusively the subject and predicate of the conclusion. It is possible to state a

number of rules setting forth the forms in which syllogisms, positive and negative, are valid, and ruling out incorrect forms.

How Actual Thinking Differs from Formal Logic

Inspection shows important differences between formal reasoning and thinking as it actually goes on in the mind of any person. (1) The subject matter of formal logic is strictly impersonal, as much so as the formulæ of algebra. The forms are thus independent of the attitude taken by the thinker, of his desire and intention. Thought carried on by anyone depends, on the other hand, as we have already seen, upon his habits. It is likely to be good when he has attitudes of carefulness, thoroughness, etc., and bad in the degree in which he is headlong, unobservant, lazy, moved by strong passion, tending to favor himself, etc. (2) The forms of logic are constant, unchanging, indifferent to the subject matter with which they are filled. They exclude change as much as does the fact that 2 plus 2 equals 4. Actual thinking is a *process;* it occurs, goes on; in short, it is in continual change as long as a person thinks. It has at every step to take account of subject matter; for parts of the material dealt with offer obstacles, pose problems and perplexities, while other portions indicate solutions and make the road out of intellectual difficulties. (3) Because forms are uniform and hospitable to any subject matter whatever, they pay no attention to context. Actual thinking, on the other hand, always has reference to some context. It occurs, as we have seen, because of some unsettled situation that itself lies outside of thinking. We may compare the formal syllogism about Socrates with the state of mind of his disciples when they were considering at the time of his trial the prospects of Socrates' continuing to live.

Thought as Logical Form, or Product, and as Psychological Process

It follows from these contrasts that thought is looked at from two different points of view. These two points of view are indicated in the title of this chapter. We call them product and process; logical form and existent, or psychological, process. They may also be termed the historical, or chronological, and the timeless. Forms are constant; thinking takes time. It is evident that education is primarily concerned with thinking as it actually takes place in individual human beings. It is concerned to create attitudes favorable to effective thought, and it has to select and arrange subject matter and the activities dealing with subject matter so as to promote these attitudes.

It does not follow, however, that formal treatment lacks all value for education. It has value, provided it is put and kept in its place. That place is suggested by giving it the name 'product.' It sets forth forms into which the result of actual thinking is thrown in order to help test its worth. Consider, as an analogy, the relation that a map sustains to the explorations and surveys of which it is the outcome. The latter correspond to processes. The map is the product. *After* it is constructed, it can be used without any reference to the journeys and expeditions of which it is the fruit, although it would not exist if it had not been for them. When you look at a map of the United States, you do not have, in order to use it, to think of Columbus, Champlain, Lewis and Clark, and the thousands of others whose trials and labors are embodied in it.

Now the map is all there before you at once. It may with propriety be called the *form* of all the special journeyings from place to place that can be undertaken by any number of persons. Moreover, when a person is traveling, it serves,

if he knows how to use it, as a check on his position and a guide to his movements. But it does not tell him where to go; his own desires and plans determine his goal, as his own past determines where he is now and where he must start from.

Logical Forms Not Used in Actual Thinking, But to Set Forth Results of Thinking

Logical forms such as one finds in a logical treatise do not pretend to tell *how* we think or even how we *should* think. No one ever arrived at the idea that Socrates, or any other creature, was mortal by following the form of the syllogism. If, however, one who has arrived at that notion by gathering and interpreting evidence wishes to expound to another person the *grounds* of his belief, he might use the syllogistic form and would do so if he wished to state the proof in its most compact form. A lawyer, for example, who knows in advance what he wants to prove, who has a conclusion already formed in his mind, and who wishes to impress others with it, is quite likely to put his reasonings into syllogistic form.

In short, these forms apply not to *reaching* conclusions, not to *arriving* at beliefs and knowledge, but to the most effective way in which to set forth what has already been concluded, so as to convince others (or oneself if one wishes to recall to mind its grounds) of the soundness of the result. In the thinking by which a conclusion is actually reached, observations are made that turn out to be aside from the point; false clues are followed; fruitless suggestions are entertained; superfluous moves are made. Just because you do not know the solution of your problem, you have to grope toward it and grope in the dark or at least in an obscure light; you start on lines of inquiry that in the end you give up. When you are only seeking the truth and

of necessity seeking somewhat blindly, you are in a radically different position from the one you are in when you are already in possession of truth.

The logical forms that characterize conclusions reached and adopted cannot therefore prescribe the way in which we should attempt to arrive at a conclusion when we are still in a condition of doubt and inquiry. Yet partial conclusions emerge during the course of reflection. There are temporary stopping places, landings of past thought that are also stations of departure for subsequent thought. We do not reach *the* conclusion at a single jump. At every such landing stage it is useful to retrace the processes gone through and to state to oneself how much and how little of the material previously thought about really bears on the conclusion reached and *how* it bears. Thus premises and conclusions are formulated at the same time in definite relation to one another, and *forms* belong to such formulations.

Actual Thinking Has Its Own Logic; It Is Orderly, Reasonable, Reflective

The distinction between process and product of reflective inquiry is thus not fixed and absolute. In calling the process 'psychological' and the product 'logical,' we do not mean that only the final outcome is logical or that the activity that goes in a series of steps in time and that involves personal desire and purpose is not logical. Rather, we must distinguish between the logical *form,* which applies to the product, and the logical *method,* which may and should belong to the process.

We speak of the 'logic' of history; that is, of the orderly movement of events to a concluding climax. We say that one person acts or talks 'logically,' another person 'illogically.' We do not mean that the first person acts, thinks, or talks in syllogisms, but that there is *order,* consecutiveness,

in what he says and does; that the means he uses are well calculated to reach the end he has in mind. 'Logically' in such cases is a synonym for 'reasonably.' The illogical person wanders aimlessly; he shifts his topic without being aware of it; he skips about at random; he not only jumps to a conclusion (all of us have to do that at some point), but he fails to retrace his steps to see whether the conclusion to which he has jumped is supported by evidence; he makes contradictory, inconsistent statements without being sensitive to what he is doing.

A person, on the other hand, thinks logically when he is careful in the conduct of his thinking, when he takes pains to make sure he has evidence to go upon, and when, after reaching a conclusion, he checks it by the evidence he can offer in its support. In short, 'logical,' as applied to the process of thinking, signifies that the course of thoughts is carried on *reflectively*, in the sense in which reflection was discriminated from other kinds of thinking. A bungler can make a box, but the joints will not fit exactly; the edges will not be even. A skilled person will do the work in a way that does not waste time or material, and the result is firm and neat. So it is with thinking.

When we say a person is *thoughtful*, we mean something more than that he merely indulges in thoughts. To be really thoughtful is to be logical. Thoughtful persons are heedful, not rash; they look about, are circumspect instead of going ahead blindly. They weigh, ponder, deliberate — terms that imply a careful comparing and balancing of evidence and suggestions, a process of evaluating what occurs to them in order to decide upon its force and weight for their problem. Moreover, the thoughtful person looks into matters; he scrutinizes, inspects, examines. He does not, in other words, take observations at their face value, but probes them to see whether they are what they seem to be.

"Skim milk masquerades as cream"; a fungus looks like an edible mushroom, but is poisonous; 'fool's gold' seems like gold, but is only iron pyrites. There are comparatively few cases in which we can accept without questioning the so-called 'evidence of the senses'; the sun does not really travel around the earth; the moon does not actually change its own form, and so on. The logical person inspects to make sure of his data. Finally, the thoughtful person 'puts two and two together.' He reckons, calculates, casts up an account. The word 'reason' is connected etymologically with the word 'ratio.' The underlying idea here is *exactness of relationship*. All reflective thinking is a process of detecting relations; the terms just used indicate that *good* thinking is not contented with finding 'any old kind' of relation but searches until a relation is found that is as accurately defined as conditions permit.

In Summary

The 'psychological,' as we use the term, is not, then, opposed to the 'logical.' As far as an actual process of thought is truly reflective, it is alert, careful, thorough, definite, and accurate, pursuing an orderly course. In short, it is then logical. When we use the term 'logical' in distinction from the actual process (when the latter is controlled), we have in mind the *formal* arrangement of the final *product* of a particular process of thinking, the arrangement being such as to sum up the net conclusion and to extract the exact grounds on which that conclusion rests. Loose thought leaves the result hanging in the air, with only a vague sense of just what has been proved or arrived at. A genuinely reflective activity terminates in declaring just what the outcome is. By formulating that outcome as definitely as possible, it is converted into a true *conclusion*. Reflective activity also makes a survey, a review, of the material upon which *alone*

this conclusion rests, and thus formulates the *premises* upon which it rests. A geometrical demonstration, for example, always states at its close just what has been proved; and if the reasoning is understood and not merely memorized, the mind grasps the demonstrated proposition as a conclusion; it is aware of the prior points that prove it.

II. Education in Relation to Form

Learning Is Learning to Think

From what has been said, however, it is evident that education, *upon its intellectual side*, is vitally concerned with cultivating the attitude of reflective thinking, preserving it where it already exists, and changing looser methods of thought into stricter ones whenever possible. Of course, education is not exhausted in its intellectual aspect; there are practical attitudes of efficiency to be formed, moral dispositions to be strengthened and developed, esthetic appreciations to be cultivated. But in all these things there is at least an element of conscious meaning and hence of thought. Otherwise, practical activity is mechanical and routine, morals are blind and arbitrary, and esthetic appreciation is sentimental gush. In what follows we shall confine ourselves, however, to the intellectual side. We state emphatically that, *upon its intellectual side education consists in the formation of wide-awake, careful, thorough habits of thinking.*

Of course intellectual learning includes the amassing and retention of information. But information is an undigested burden unless it is understood. It is *knowledge* only as its material is *comprehended*. And understanding, comprehension, means that the various parts of the information acquired are grasped in their relations to one another — a re-

sult that is attained only when acquisition is accompanied by constant reflection upon the meaning of what is studied. There is an important distinction between verbal, mechanical memory and what older writers called 'judicious memory.' The latter seizes the *bearings* of what is retained and recalled; it can, therefore, use the material in new situations where verbal memory would be completely at a loss.

What we have called 'psychological thinking' is just the actual process that takes place. This, in particular cases, may be random and disorderly or else a mere play of fantasy. But if it were *always* nothing but that, not only would thinking be of no use, but life could hardly be even maintained. If thought had nothing to do with real conditions and if it did not move logically from these conditions to the thought of ends to be reached, we should never invent, or plan, or know how to get out of any trouble or predicament. As we have already noted, there are both intrinsic elements and pressure of circumstances that introduce into thinking genuinely logical or reflective qualities.

The Connection between Process and Product of Thinking Overlooked by Two Educational Schools

Curiously enough, the internal and necessary connection between the actual process of thinking and its intellectual product is overlooked by two opposite educational schools.

One of these schools thinks that the mind is naturally so illogical in its processes that logical form must be impressed upon it from without. It assumes that logical quality belongs only to organized knowledge and that the operations of the mind become logical only through absorption of logically formulated, ready-made material. In this case, the logical formulations are not the outcome of any process of thinking that is personally undertaken and carried out; the formulation has been made by another mind and is

presented in a finished form, apart from the processes by which it was arrived at. Then it is assumed that by some magic its logical character will be transferred into the minds of pupils.

An illustration or two will make clear what is meant by the foregoing statements. Suppose the subject is geography. The first thing is to give its definition, marking it off from every other subject. Then the various abstract terms upon which depends the scientific development of the science are stated and defined one by one — pole, equator, ecliptic, zone — from the simpler units to the more complex that are formed out of them; then the more concrete elements are taken in similar series — continent, island, coast, promontory, cape, isthmus, peninsula, ocean, lake, coast, gulf, bay, and so on. In acquiring this material the pupil's mind is supposed not only to gain important information, but, by accommodating itself to ready-made logical definitions, generalizations, and classifications, gradually also to acquire logical habits.

This type of method has been applied to every subject taught in the schools — reading, writing, music, physics, grammar, arithmetic. Drawing, for example, has been taught on the theory that, since all pictorial representation is a matter of combining straight and curved lines, the simplest procedure is to have the pupil acquire the ability first to draw straight lines in various positions (horizontal, perpendicular, diagonals at various angles), then typical curves; and finally, to combine straight and curved lines in various permutations to construct actual pictures. This seemed to give the ideal 'logical' method, beginning with analysis into elements, and then proceeding in regular order to more and more complex syntheses, each element being defined when used, and thereby clearly understood.

Even when this method in its extreme form is not fol-

lowed, few schools (especially of the middle or upper elementary grades) are free from an exaggerated attention to forms supposedly necessary for the pupil to use if he is to get his result logically. It is held that there are certain steps, arranged in a certain order, that express preëminently an understanding of the subject, and the pupil is made to 'analyze' his procedure into these steps; *i.e.*, to learn a certain routine formula of statement. While this method is usually at its height in grammar and arithmetic, it invades also history and even literature, which are then reduced, under plea of intellectual training, to outlines, diagrams, and other schemes of division and subdivision. In memorizing this simulated cut-and-dried copy of the logic of an adult, the child is generally made to stultify his own vital logical movement. The adoption by teachers of this misconception of logical method has probably done more than anything else to bring pedagogy into disrepute, for to many persons 'pedagogy' means precisely a set of mechanical, self-conscious devices for replacing by some cast-iron external scheme the personal mental movement of the individual.

It is evident from these examples that in such a scheme of instruction the logical is identified exclusively with certain formal properties of subject matter; with subject matter defined, refined, subdivided, classified, organized according to certain principles of connection that have been worked out by persons who are expert in that particular field. It conceives the method of instruction to be the devices by which similar traits are imported into the mind by careful reproduction of the given material in arithmetic, geography, grammar, physics, biology, or whatnot. The natural operations of the mind are supposed to be indifferent or even averse to all logical achievement. Hence the mottoes of this school are 'discipline,' 'restraint,' 'con-

scious effort,' 'the necessity of tasks,' and so on. From this point of view studies, rather than attitudes and habits, embody the logical factor in education. The mind becomes logical only by learning to conform to an external subject matter. To produce this conformity, the study should first be analyzed (by textbook or teacher) into its logical elements; then each of these elements should be defined; finally, all the elements should be arranged in series or classes according to logical formulæ or general principles. Then the pupil learns the definitions one by one and, progressively adding one to another, builds up the logical system, and thereby is himself gradually imbued, from without, with logical quality.

A reaction inevitably occurs from the poor results that accrue from these professedly 'logical' methods. Lack of interest in study, habits of inattention and procrastination, positive aversion to intellectual application, dependence upon sheer memorizing and mechanical routine with only a modicum of understanding by the pupil of what he is about, show that the theory of logical definition, division, gradation, and system does not work out practically as it is theoretically supposed to do. The consequent disposition — as in every reaction — is to go to the opposite extreme. The 'logical' is thought to be wholly artificial and extraneous; teacher and pupil alike are to turn their backs upon it, and to give free rein to the expression of existing aptitudes and tastes. Emphasis upon natural tendencies and powers as the only possible starting point of development is indeed wholesome. But the reaction is false, and hence misleading, in what it ignores and denies: the presence of genuinely intellectual factors in existing powers and interests.

The other type of school really accepts the underlying premise of the opposite educational theory. It also assumes

that the mind is naturally averse to logical form; it grounds this conviction upon the fact that many minds *are* rebellious to the particular logical forms in which a certain type of textbook presents its material. From this fact it is inferred that logical order is so foreign to the natural operations of the mind that it is of slight importance in education, at least in that of the young, and that the main thing is just to give free play to impulses and desires without regard to any definitely *intellectual* growth. Hence the mottoes of this school are 'freedom,' 'self-expression,' 'individuality,' 'spontaneity,' 'play,' 'interest,' 'natural unfolding,' and so on. In its emphasis upon individual attitude and activity, it sets slight store upon organized subject matter. It conceives *method* to consist of various devices for stimulating and evoking, in their natural order of growth, the native potentialities of individuals.

The Basic Error of the Two Schools Is the Same

Thus the basic error of the two schools is the same. Both ignore and virtually deny the fact that tendencies toward a reflective and truly logical activity are native to the mind, and that they show themselves at an early period, since they are demanded by outer conditions and stimulated by native curiosity. There is an innate disposition to draw inferences, and an inherent desire to experiment and test. The mind at every stage of growth has its own logic. It entertains suggestions, tests them by observation of objects and events, reaches conclusions, tries them in action, finds them confirmed or in need of correction or rejection. A baby, even at a comparatively early period, makes inferences in the way of expectations from what is observed, interpreting what it sees as a sign or evidence of something it does not observe with the senses. The school of so-called 'free self-expression' thus fails to note that one thing that is urgent

for expression in the spontaneous activity of the young is *intellectual* in character. Since this factor is predominantly the *educative* one, as far as instruction is concerned, other aspects of activity should be made means to its effective operation.

Any teacher who is alive to the modes of thought operative in the natural experience of the normal child will have no difficulty in avoiding the identification of the logical with a ready-made organization of subject matter, as well as the notion that the way to escape this error is to pay no attention to logical considerations. Such a teacher will have no difficulty in seeing that the real problem of intellectual education is the *transformation* of natural powers into expert, tested powers: the transformation of more or less casual curiosity and sporadic suggestion into attitudes of alert, cautious, and thorough inquiry. He will see that the *psychological* and the *logical*, instead of being opposed to each other (or even independent of each other), are connected as the earlier and the terminal, or concluding, stages of the same process. He will recognize, moreover, that the kind of logical arrangement that marks subject matter at the stage of maturity is not the only kind possible; that the kind found in scientifically organized material is actually undesirable until the mind has reached a point of maturity where it is capable of understanding just *why* this form, rather than some other, is adopted.

That which is strictly logical from the standpoint of subject matter really represents the conclusions of an expert, trained mind. The definitions, divisions, and classifications of the conventional text represent these conclusions boiled down. The only way in which a person can reach ability to make accurate definitions, penetrating classifications, and comprehensive generalizations is by thinking alertly and carefully on his own *present* level. Some kind of intellectual

organization must be required, or else habits of vagueness, disorder, and incoherent 'thinking' will be formed. But the organization need not be that which would satisfy the mature expert. For the immature mind is still in process of gaining the intellectual skill that the latter has already achieved. It is absurd to suppose that the beginner can commence where the adept stops. But the beginner should be trained to demand from himself careful examination, consecutiveness, and some sort of summary and formulation of *his* conclusions, together with a statement of the reasons for them.

In Summary

We may summarize by saying that 'logical' has at least three different meanings. In its widest sense, any thinking that is intended to reach a conclusion that is to be accepted and believed in is logical, even though the actual operations are *il*-logical. In the narrowest sense, 'logical' signifies that which is demonstrated, according to certain approved forms, to follow from premises the terms of which have clear and definite meanings; it signifies *proof of a stringent character.* Between the two lies the meaning, which is educationally vital: systematic care to safeguard the processes of thinking so that it is truly reflective. In this connection, 'logical' signifies the *regulation* of natural and spontaneous processes of observation, suggestion, and testing; that is, thinking as an *art.*

III. Discipline and Freedom

The Conception of Discipline

It was remarked in the foregoing discussion that two schools of educational thought have opposing mottoes, or slogans. One of them makes *discipline* primary; the other,

freedom. The position we have taken implies, however, that each school has a wrong notion of the meaning of its own professed principle. If the natural, or 'psychological,' processes are lacking in all inherent logical quality, so that the latter has to be imposed from without, then discipline must be something negative. It will be a painfully disagreeable forcing of mind away from channels congenial to it into channels of constraint, a process grievous at the time but necessary as preparation for a more or less remote future. Discipline is then generally identified with drill; and drill is conceived after the mechanical analogy of driving, by unremitting blows, a foreign substance into a resistant material; or is imaged after the analogy of the mechanical routine by which raw recruits are trained to a soldierly bearing and habits that are naturally wholly foreign to their possessors. Training of this latter sort, whether it be called 'discipline' or not, is not *mental* discipline. Its aim and result are not *habits* of thinking, but uniform *external modes of action*. By failing to ask what he means by discipline, many a teacher is misled into supposing that he is engaged in disciplining the mind of pupils, when in reality he is creating an aversion to study and a belief that using the mind is a disagreeable, instead of a delightful, operation.

In truth, discipline is positive and constructive. It is power, power of control of the means necessary to achieve ends and also power to value and test ends. A painter is disciplined in his art in the degree in which he can manage and use effectively all the elements that enter into his art — externally, canvas, colors, and brush; internally, his power of vision and imagination. Practice, exercise, are involved in the acquisition of power, but they do not take the form of meaningless drill, but of practising the *art*. They occur as part of the operation of attaining a desired end, and they are not mere repetition. Discipline is a product, an

outcome, an achievement, not something applied from without. All genuine education *terminates* in discipline, but it *proceeds* by engaging the mind in activities worth while for their own sake.

The Conception of Freedom

This fact enables us to see the error in the conception of freedom held by the opposite school of educational theory. The discipline that is identical with trained power is also identical with *freedom*. For freedom is power to act and to execute independent of external tutelage. It signifies mastery capable of independent exercise, emancipated from the leading strings of others, not mere unhindered external operation. When spontaneity or naturalness is identified with more or less casual discharge of transitory impulses, the tendency of the educator is to supply a multitude of stimuli in order that spontaneous activity may be kept up. All sorts of interesting materials, equipments, tools, modes of activity, are provided in order that there may be no flagging of free self-expression. This method overlooks some of the essential conditions of the attainment of genuine freedom.

Freedom Is Achieved by Conquering Obstacles

Direct immediate discharge or expression of an impulsive tendency is fatal to thinking. Only when the impulse is to some extent checked and thrown back upon itself does reflection ensue. It is, indeed, a stupid error to suppose that arbitrary tasks must be imposed from without in order to furnish the factor of perplexity and difficulty that is the necessary cue to thought. Every vital activity of any depth and range inevitably meets obstacles in the course of its effort to realize itself — a fact that renders the search for artificial or external problems quite superfluous. The difficulties that present themselves within the development of

an experience are, however, to be cherished by the educator, not minimized, for they are the natural stimuli to reflective inquiry. Freedom does not consist in keeping up an uninterrupted and unimpeded external activity, but is something achieved through conquering, by personal reflection, the difficulties that prevent immediate overflow into action and spontaneous success.

Thinking Demands a Natural Development from Early Childhood

A method that emphasizes the psychological and natural, yet fails to see what an important part of natural tendencies is constituted at every period of growth by curiosity, inference, and the desire to test, cannot secure a *natural development.* In natural growth each successive stage of activity prepares unconsciously, but thoroughly, the conditions for the manifestation of the next stage — as in the cycle of a plant's growth. There is no ground for assuming that thinking is a special, isolated natural tendency that will bloom inevitably in due season simply because various sense and motor activities have been freely manifested before; or because observation, memory, imagination, and manual skill have been previously exercised without thought. Only when thinking is constantly employed in using the senses and muscles for the guidance and application of observations and movements is the way prepared for subsequent higher types of thinking.

At present, the notion is current that childhood is almost entirely unreflective — a period of mere sensory, motor, and memory development, while adolescence suddenly brings the manifestation of thought and reason.

Adolescence is not, however, a synonym for magic. Doubtless youth should bring with it an enlargement of the horizon of childhood, a susceptibility to larger concerns and

issues, a more generous and a more general standpoint toward nature and social life. This development affords an opportunity for thinking of a more comprehensive and abstract type than has previously obtained. But thinking itself remains just what it has been all the time, a matter of following up and testing the conclusions suggested by the facts and events of life. Thinking begins as soon as the baby who has lost the ball that he is playing with begins to foresee the possibility of something not yet existing — its recovery — and begins to forecast steps toward the realization of this possibility, and, by experimentation, to guide his acts by his ideas and thereby also test the ideas. Only by making the most of the thought factor already active in the experiences of childhood, is there any promise or warrant for the emergence of superior reflective power at adolescence or at any later period.

Mental Habits, whether Good or Bad, Are Certain to Be Formed

In any case *positive habits are being formed:* if not habits of careful looking into things, then habits of hasty, heedless, impatient glancing over the surface; if not habits of consecutively following up the suggestions that occur, then habits of haphazard, grasshopper-like guessing; if not habits of suspending judgment till inferences have been tested by the examination of evidence, then habits of credulity alternating with flippant incredulity, belief or unbelief being based, in either case, upon whim, emotion, or accidental circumstances. The only way to achieve traits of carefulness, thoroughness, and continuity (traits that are, as we have seen, the elements of the 'logical') is by exercising these traits from the beginning, and by seeing to it that conditions call for their exercise.

Genuine Freedom Is Intellectual

Genuine freedom, in short, is intellectual; it rests in the trained *power of thought,* in ability to 'turn things over,' to look at matters deliberately, to judge whether the amount and kind of evidence requisite for decision is at hand, and if not, to tell where and how to seek such evidence. If a man's actions are not guided by thoughtful conclusions, then they are guided by inconsiderate impulse, unbalanced appetite, caprice, or the circumstances of the moment. To cultivate unhindered, unreflective external activity is to foster enslavement, for it leaves the person at the mercy of appetite, sense, and circumstance.

CHAPTER SIX

EXAMPLES OF INFERENCE AND TESTING

We have in previous chapters given an outline account of the nature of reflective thinking. We have stated some reasons why it is necessary to use educational means to secure its development and have considered the intrinsic resources, the difficulties, and ulterior purpose of its educational training — the formation of disciplined logical ability to think. We come now to some descriptions of simple genuine cases of thinking, selected from the class papers of students.

I. Illustrations of Reflective Activity

We have had repeated occasion to notice that there are both external and internal circumstances that call out and that guide, to some extent, thought of the reflective kind. Practical needs in connection with existing conditions, natural and social, evoke and direct thought. We begin with an instance of that sort. We have noted also that curiosity is a strong drive from within, and accordingly our second example is drawn from that field. Finally, a mind that is already exercised in scientific subjects will have inquiry aroused by intellectual problems, and our third instance is of that type.

A Case of Practical Deliberation

The other day, when I was down town on 16th Street, a clock caught my eye. I saw that the hands pointed to

12:20. This suggested that I had an engagement at 124th Street, at one o'clock. I reasoned that as it had taken me an hour to come down on a surface car, I should probably be twenty minutes late if I returned the same way. I might save twenty minutes by a subway express. But was there a station near? If not, I might lose more than twenty minutes in looking for one. Then I thought of the elevated, and I saw there was such a line within two blocks. But where was the station? If it were several blocks above or below the street I was on, I should lose time instead of gaining it. My mind went back to the subway express as quicker than the elevated; furthermore, I remembered that it went nearer than the elevated to the part of 124th Street I wished to reach, so that time would be saved at the end of the journey. I concluded in favor of the subway, and reached my destination by one o'clock.

A Case of Reflection upon an Observation

Projecting nearly horizontally from the upper deck of the ferryboat on which I daily cross the river is a long white pole, bearing a gilded ball at its tip. It suggested a flagpole when I first saw it; its color, shape, and gilded ball agreed with this idea, and these reasons seemed to justify me in this belief. But soon difficulties presented themselves. The pole was nearly horizontal, an unusual position for a flagpole; in the next place, there was no pulley, ring, or cord by which to attach a flag; finally, there were elsewhere two vertical staffs from which flags were occasionally flown. It seemed probable that the pole was not there for flag-flying.

I then tried to imagine all possible purposes of such a pole, and to consider for which of these it was best suited: (*a*) Possibly it was an ornament. But as all the

ferryboats and even the tugboats carried poles, this hypothesis was rejected. (*b*) Possibly it was the terminal of a wireless telegraph. But the same considerations made this improbable. Besides, the more natural place for such a terminal would be the highest part of the boat, on top of the pilot house. (*c*) Its purpose might be to point out the direction in which the boat is moving.

In support of this conclusion, I discovered that the pole was lower than the pilot house, so that the steersman could easily see it. Moreover, the tip was enough higher than the base, so that, from the pilot's position, it must appear to project far out in front of the boat. Moreover, the pilot being near the front of the boat, he would need some such guide as to its direction. Tugboats would also need poles for such a purpose. This hypothesis was so much more probable than the others that I accepted it. I formed the conclusion that the pole was set up for the purpose of showing the pilot the direction in which the boat pointed, to enable him to steer correctly.

A Case of Reflection Involving Experiment

In washing tumblers in hot soapsuds and placing them mouth downward on a plate, I noticed that bubbles appeared on the outside of the mouth of the tumblers and then went inside. Why? The presence of bubbles suggests air, which I note must come from inside the tumbler. I see that the soapy water on the plate prevents escape of the air save as it may be caught in bubbles. But why should air leave the tumbler? There was no substance entering to force it out. It must have expanded. It expands by increase of heat or by increase of pressure, or by both. Could the air have become heated after the tumbler was taken from the hot

suds? Clearly not the air that was already entangled in the water. If heated air was the cause, cold air must have entered in transferring the tumblers from the suds to the plate. I test to see whether this supposition is true by taking several more tumblers out. Some I shake so as to make sure of entrapping cold air in them. Some I take out, holding them mouth downward in order to prevent cold air from entering. Bubbles appear on the outside of every one of the former and on none of the latter. I must be right in my inference. Air from the outside must have been expanded by the heat of the tumbler, which explains the appearance of the bubbles on the outside.

But why do they then go inside? Cold contracts. The tumbler cooled and also the air inside it. Tension was removed, and hence bubbles appeared inside. To be sure of this, I test by placing a cap of ice on the tumbler while the bubbles are still forming outside. They soon reverse.

These Three Cases Form a Series

These three cases have been purposely selected so as to form a series from the more rudimentary to more complicated cases of reflection. The first illustrates the kind of thinking done by everyone during the day's business, in which neither the data nor the ways of dealing with them lie outside the limits of everyday experience. The last furnishes a case in which neither problem nor mode of solution would have occurred except to one with some prior scientific training. The second case forms a natural transition; its materials lie well within the bounds of everyday, unspecialized experience; but the problem, instead of being directly involved in the person's business, arises indirectly in connection with what he happened to be doing and appeals to a somewhat theoretic and impartial interest.

In the next chapter we shall give an analytic account of what the three instances exhibit in common. In what immediately follows we shall set forth, first, how they all illustrate the nature of that operation of *inference* which is the heart of all intelligent action, and second, how the aim and outcome of thinking in all cases is the transformation of a *dubious* and perplexing situation into a *settled,* or determinate, one.

II. Inference to the Unknown

No Thought without Inference

In every case of reflective activity, a person finds himself confronted with a given, present situation from which he has to arrive at, or conclude to, something else that is not present. This process of arriving at an idea of what is absent on the basis of what is at hand is *inference.* What is present *carries* or *bears* the mind over to the idea and ultimately the acceptance of something else. From the consideration of established facts of location and time of day, the person in the first case cited made an inference as to the best way to travel in order to keep an appointment, which is a future and, at first, uncertain event. From observed and remembered facts, the second person inferred the probable use of a long pole. From the presence under certain conditions of bubbles and from a knowledge of securely established physical facts and principles, the third person inferred the explanation or cause of a particular event, previously unknown; namely, the movement of water in the form of bubbles from the outside to the inside of a tumbler.

Inference Involves a Leap

Every inference, just because it goes beyond ascertained and known facts, which are given either by observation or by recollection of prior knowledge, involves a *jump from the known into the unknown*. It involves a leap beyond what is given and already established. As we have already noted,[1] the inference occurs via or through the suggestion that is aroused by what is seen and remembered. Now, while the suggestion pops into the mind, just *what* suggestion occurs depends first upon the experience of the person. This in turn is dependent upon the general state of culture of the time; suggestions, for example, that occur readily now could not possibly spring up in the mind of a savage. Second, suggestions depend upon the person's own preferences, desires, interests, or even his immediate state of passion. The inevitableness of suggestion, the lively force with which it springs before the mind, the natural tendency to accept it if it is plausible or not obviously contradicted by facts, indicate the necessity of controlling the suggestion which is made the basis of an inference that is to be believed.

Proving Is Testing

This control of inference prior to, and on behalf of, belief constitutes *proof*. To prove a thing means primarily to *test* it. The guest bidden to the wedding feast excused himself because he had to *prove* his oxen. Exceptions are said to prove a rule; *i.e.*, they furnish instances so extreme that they try in the severest fashion its applicability; if the rule will stand such a test, there is no good reason for further doubting it. Not until a thing has been tried — 'tried out,' in colloquial language — do we know its true worth. Till then it may be pretense, a bluff. But the thing that has come out

[1] See pages 10 and 41.

victorious in a test or trial of strength carries its credentials with it; it is approved, because it has been proved. Its value is clearly evinced, shown; *i.e.*, demonstrated. So it is with inferences. The mere fact that inference in general is an invaluable function does not guarantee, nor does it even help out, the correctness of any particular inference. Any inference may go astray; as we have seen, there are standing influences ever ready to instigate it to go wrong. *What is important is that every inference be a tested inference; or* (since often this is not possible) *that we discriminate between beliefs that rest upon tested evidence and those that do not, and be accordingly on our guard as to the kind and degree of assent or belief that is justified.*

Two Kinds of Testing

All three instances manifest the presence of testing operations that transform what would otherwise have been loose thinking into reflective activity. Examination reveals that the testing is of two kinds. Suggested inferences are tested in *thought* to see whether different elements in the suggestion are coherent with one another. They are also tested, after one has been adopted, by *action* to see whether the consequences that are anticipated in *thought* occur in *fact*. A good example of this second kind of proving is found in the first case cited, where reasoning had led to the conclusion that the use of the subway would bring the person to the place of his appointment in time. He tried or tested the idea by acting upon it, and the result confirmed the idea by bringing what was inferred actually to pass.

In the second case, the test by action could occur only as the person *imagined* himself in the place of the pilot who was using the pole to steer by. The test of coherence or consistency is markedly in evidence. Suggestions of flagpole, ornament, wireless, were rejected because, as soon as they

were reflected upon, it was seen that they did not fit into some elements of the observed facts; they were dropped because they failed to agree with these elements. The idea that the pole was used to show the direction of movement of the boat, on the contrary, was found to agree with a number of important elements, such as (*a*) the need of the pilot, (*b*) the height of the pole, (*c*) the relative locations of its base and tip.

In the third instance, both kinds of testing are employed. After the conclusion was reached, it was acted upon by a further experiment, undertaken not only in imagination but also in fact. A cap of ice was placed upon the tumbler, and the bubbles behaved as they should behave if the inference was the correct one. Hence it was borne out, corroborated, verified. Others testing acts occurred in the process by using different ways of taking tumblers out of the water. The testing of consistency in thought occurred by reflecting upon the nature of expansion in its relation to heat and by considering whether the observed phenomena agreed with the facts that would have to follow from this principle. Obviously the use of both methods of proving a proposed inference is better than one alone. The two methods do not differ, however, in kind. Testing in thought for consistency involves acting in *imagination*. The other mode carries the imagined act out overtly. True inference is defined first as involving a leap to a suggested conclusion, and second as *trying* the suggestion to determine its agreement with the requirements of the situation. The original pattern of reflective action is set by cases in which the need for doing something is urgent, and where the results of what is done test the value of thought. As intellectual curiosity develops, connection with overt action becomes indirect and incidental. Yet it persists even if only in imagination.

III. Thinking Moves from a Doubtful to a Settled Situation

It Arises from a Directly Experienced Situation

Examination of the instances will show that in each case thinking arises out of a directly experienced situation. Persons do not just think at large, nor do ideas arise out of nothing. In one case a student is busy in a certain part of a city and is reminded of an engagement at another place. In the second case a person is engaged in riding on a ferry-boat and begins to wonder about something in the construction of the boat. In the third case a student with prior scientific training is busy washing dishes. In each case the nature of the situation as it is actually experienced arouses inquiry and calls out reflection.

There is nothing in this fact peculiar to these special instances. Go through your own experience and you will not find a case where thinking started up out of nothing. Sometimes the train of thoughts will have taken you so far away from the starting point that you will have difficulty in getting back to that prior something out of which the thinking arose, but follow the thread far enough and you will find some situation that is directly experienced, something undergone, done, enjoyed, or suffered, and not just thought of. Reflection is occasioned by the character of this primary situation. It does not merely *grow out* of it, but it *refers back* to it. Its aim and outcome are decided by the situation out of which it arose.

Probably the most frequent cause of failure in school to secure genuine thinking from students is the failure to insure the existence of an experienced situation of such a nature as to call out thinking in the way in which these out-of-school situations do. A teacher was troubled by the fail-

ure of pupils, when dealing with arithmetical problems in multiplication involving decimals, to place the decimal point correctly. The numerical figures would be correct, but the values all wrong. One student might, for example, say $320.16; another, $32.016; and a third, $3201.60. This result showed that, while the pupils could manipulate figures correctly, they did not *think*. For if they had used thought, they would not vary so arbitrarily in grasping the values involved. Accordingly he sent the pupils to a lumberyard to purchase boards for use in the manual-training shop, having arranged with the dealer to let *them* figure the cost of their purchases. The same numerical operations were involved as in the textbook problems. No mistakes at all were made in placing the decimal. The situation itself induced them to think and controlled their grasp of the values involved. The contrast between the textbook problem and the requirements of the actual purchase in the lumberyard provides an excellent example of the necessity of a situation in order to induce and direct thought.

It Moves toward a Settled Situation

Examination of the three cases also shows that each situation is in some fashion uncertain, perplexed, troublesome, if only in offering to the mind an unresolved difficulty, an unsettled question. It shows in each case that the function of reflection is to bring about a new situation in which the difficulty is resolved, the confusion cleared away, the trouble smoothed out, the question it puts answered. Any particular process of thinking naturally comes to its close when the situation before the mind is settled, decided, orderly, clear, for then there is nothing to call out reflection until a new bothersome or doubtful situation arises.

The function of reflective thought is, therefore, to transform a situation in which there is experienced obscurity,

doubt, conflict, disturbance of some sort, into a situation that is clear, coherent, settled, harmonious.

The *stated* conclusion, the conclusion that is set forth in a proposition, is not the *final* conclusion but is the key to its formation. For example, the first person reached the conclusion "the best way to 124th Street is the subway train." But that conclusion was only the *key* to reaching the ultimate conclusion; namely, the keeping of an engagement. Thinking was the means of developing the original, perplexed situation into an eventual, satisfactory one. You can readily make similar analyses in the case of the other two illustrations. One great difficulty with the 'logical,' the exclusively formal type of which we spoke in the previous chapter, is that it begins and ends with mere propositions instead of bringing before the imagination the two actual life-situations to which the propositions refer; the one, which contains the doubt or difficulty, and the other, which is the final desired outcome and which was brought about by means of reflection.

There is no better way to decide whether genuine inference has taken place than to ask whether it terminated in the substitution of a clear, orderly, and satisfactory situation for a perplexed, confused, and discordant one. Partial and ineffectual thinking ends in conclusions that are formally correct but that make no difference in what is personally and immediately experienced. Vital inference always leaves one who thinks with a world that is experienced as different in some respect, for some object in it has gained in clarity and orderly arrangement. Genuine thinking winds up, in short, with an appreciation of new values.

CHAPTER SEVEN

ANALYSIS OF REFLECTIVE THINKING

I. Facts and Ideas

When a situation arises containing a difficulty or perplexity, the person who finds himself in it may take one of a number of courses. He may dodge it, dropping the activity that brought it about, turning to something else. He may indulge in a flight of fancy, imagining himself powerful or wealthy, or in some other way in possession of the means that would enable him to deal with the difficulty. Or, finally, he may face the situation. In this case, he begins to reflect.

Reflection Includes Observation

The moment he begins to reflect, he begins of necessity to observe in order to take stock of conditions. Some of these observations are made by direct use of the senses; others by recollecting observations previously made either by himself or by others. The person who had the engagement to keep, notes with his eyes his present location, recalls the place where he should arrive at one o'clock, and brings back to mind the means of transportation with which he is acquainted and their respective locations. In this way he gets as clear and distinct a recognition as possible of the nature of the situation with which he has to deal. Some of the conditions are obstacles and others are aids, resources. No matter whether these conditions come to him by direct

perception or by memory, they form the '*facts* of the case.' They are the things that are *there*, that have to be reckoned with. Like all facts, they are stubborn. They cannot be got out of the way by magic just because they are disagreeable. It is no use to *wish* they did not exist or were different. They must be taken for just what they are. Hence observation and recollection must be used to the full so as not to glide over or to mistake important features. Until the habit of thinking is well formed, facing the situation to discover the facts requires an effort. For the mind tends to dislike what is unpleasant and so to sheer off from an adequate notice of that which is especially annoying.

Reflection Includes Suggestions

Along with noting the conditions that constitute the facts to be dealt with, suggestions arise of possible courses of action. Thus the person of our illustration[1] thinks of surface cars, elevated trains, and the subway. These alternative suggestions compete with one another. By comparison he judges which alternative is best, which one is the more likely to give a satisfactory solution. The comparison takes place indirectly. The moment one thinks of a possible solution and holds it in suspense, he turns back to the facts. He has now a point of view that leads him to new observations and recollections and to a reconsideration of observations already made in order to test the worth of the suggested way out. Unless he uses the suggestion so as to guide to new observations instead of exercising suspended judgment, he accepts it as soon as it presents itself. Then he falls short of truly reflective thought. The newly noted facts may (and in any complex situation surely will) cause new suggestions to spring up. These become clews to further investigation of

[1] See page 92.

conditions. The results of this survey test and correct the proposed inference or suggest a new one. This continuous interaction of the facts disclosed by observation and of the suggested proposals of solution and the suggested methods of dealing with conditions goes on till some suggested solution meets all the conditions of the case and does not run counter to any discoverable feature of it.[2]

Data and Ideas Are Correlative and Indispensable Factors in Reflection

A technical term for the observed facts is *data*. The data form the material that has to be interpreted, accounted for, explained; or, in the case of deliberation as to what to do or how to do it, to be managed and utilized. The suggested solutions for the difficulties disclosed by observation form *ideas*. Data (facts) and ideas (suggestions, possible solutions) thus form the two indispensable and correlative factors of all reflective activity. The two factors are carried on by means respectively of *observation* (in which for convenience is included memory of prior observations of similar cases) and *inference*. The latter runs beyond what is actually noted, beyond what is found, upon careful examination, to be actually present. It relates, therefore, to what is *possible*, rather than to what is actual. It proceeds by anticipation, supposition, conjecture, imagination. All foresight, prediction, planning, as well as theorizing and speculation, are characterized by excursion from the actual into the possible. Hence (as we have already seen) what is inferred demands a double test: first, the process of forming the idea or supposed solution is checked by constant cross reference to the conditions observed to be actually present; secondly, the idea *after* it is formed is tested by *acting* upon it, overtly

[2] The statements just made should be tested and illustrated by reference to the three cases set forth in the previous chapter.

if possible, otherwise in imagination. The consequences of this action confirm, modify, or refute the idea.

We shall illustrate what has been said by a simple case. Suppose you are walking where there is no regular path. As long as everything goes smoothly, you do not have to think about your walking; your already formed habit takes care of it. Suddenly you find a ditch in your way. You think you will jump it (supposition, plan); but to make sure, you survey it with your eyes (observation), and you find that it is pretty wide and that the bank on the other side is slippery (facts, data). You then wonder if the ditch may not be narrower somewhere else (idea), and you look up and down the stream (observation) to see how matters stand (test of idea by observation). You do not find any good place and so are thrown back upon forming a new plan. As you are casting about, you discover a log (fact again). You ask yourself whether you could not haul that to the ditch and get it across the ditch to use as a bridge (idea again). You judge that idea is worth trying, and so you get the log and manage to put it in place and walk across (test and confirmation by overt action).

If the situation were more complicated, thinking would of course be more elaborate. You can imagine a case in which making a raft, constructing a pontoon bridge, or making a dugout would be the ideas that would finally come to mind and have to be checked by reference to conditions of action (facts). Simple or complicated, relating to what to do in a practical predicament or what to infer in a scientific or philosophic problem, there will always be the two sides: the conditions to be accounted for, dealt with, and the ideas that are plans for dealing with them or are suppositions for interpreting and explaining the phenomena.

In predicting an eclipse, for example, a multitude of observed facts regarding position and movements of earth,

sun, and moon, comes in on one side, while on the other side the ideas employed to predict and explain involve extensive mathematical calculations. In a philosophic problem, the facts or data may be remote and not susceptible of direct observation by the senses. But still there will be data, perhaps of science, or of morals, art, or the conclusions of past thinkers, that supply the subject matter to be dealt with and by which theories are checked. On the other side, there are the speculations that come to mind and that lead to search for additional subject matter which will both develop the proposed theories as ideas and test their value. Mere facts or data are dead, as far as mind is concerned, unless they are used to suggest and test some idea, some way out of a difficulty. Ideas, on the other hand, are *mere* ideas, idle speculations, fantasies, dreams, unless they are used to guide new observations of, and reflections upon, actual situations, past, present, or future. Finally, they must be brought to some sort of check by actual given material or else remain ideas. Many ideas are of great value as material of poetry, fiction, or the drama, but not as the stuff of knowledge. However, ideas may be of intellectual use to a penetrating mind even when they do not find any immediate reference to actuality, provided they stay in the mind for use when new facts come to light.

II. The Essential Functions of Reflective Activity

We now have before us the material for the analysis of a complete act of reflective activity. In the preceding chapter we saw that the two limits of every unit of thinking are a perplexed, troubled, or confused situation at the beginning and a cleared-up, unified, resolved situation at the close. The first of these situations may be called *pre*-reflective. It

sets the problem to be solved; out of it grows the question that reflection has to answer. In the final situation the doubt has been dispelled; the situation is *post*-reflective; there results a direct experience of mastery, satisfaction, enjoyment. Here, then, are the limits within which reflection falls.

Five Phases, or Aspects, of Reflective Thought

In between, as states of thinking, are (1) *suggestions*, in which the mind leaps forward to a possible solution; (2) an intellectualization of the difficulty or perplexity that has been *felt* (directly experienced) into a *problem* to be solved, a question for which the answer must be sought; (3) the use of one suggestion after another as a leading idea, or *hypothesis*, to initiate and guide observation and other operations in collection of factual material; (4) the mental elaboration of the idea or supposition as an idea or supposition (*reasoning*, in the sense in which reasoning is a part, not the whole, of inference); and (5) testing the hypothesis by overt or imaginative action.

We shall now take up the five phases, or functions, one by one.

The First Phase, Suggestion

The most 'natural' thing for anyone to do is to go ahead; that is to say, to *act* overtly. The disturbed and perplexed situation arrests such direct activity temporarily. The tendency to continue *acting* nevertheless persists. It is diverted and takes the form of an idea or a suggestion. The *idea* of what to do when we find ourselves 'in a hole' is a substitute for direct action. It is a vicarious, anticipatory way of acting, a kind of dramatic rehearsal. Were there only one suggestion popping up, we should undoubtedly adopt it at once. But where there are two or more, they collide with

one another, maintain the state of suspense, and produce further inquiry. The first suggestion in the instance recently cited was to jump the ditch, but the perception of conditions inhibited that suggestion and led to the occurrence of other ideas.

Some inhibition of *direct* action is necessary to the condition of hesitation and delay that is essential to thinking. Thought is, as it were, conduct turned in upon itself and examining its purpose and its conditions, its resources, aids, and difficulties and obstacles.

The Second Phase, Intellectualization

We have already noted that it is artificial, so far as thinking is concerned, to start with a ready-made problem, a problem made out of whole cloth or arising out of a vacuum. In reality such a 'problem' is simply an assigned *task*. There is not at first a situation *and* a problem, much less just a problem and no situation. There is a troubled, perplexed, trying situation, where the difficulty is, as it were, spread throughout the entire situation, infecting it as a whole. If we knew just what the difficulty was and where it lay, the job of reflection would be much easier than it is. As the saying truly goes, a question well put is half answered. In fact, we know what the problem *exactly* is simultaneously with finding a way out and getting it resolved. Problem and solution stand out *completely* at the same time. Up to that point, our grasp of the problem has been more or less vague and tentative.

A blocked suggestion leads us to reinspect the conditions that confront us. Then our uneasiness, the shock of disturbed activity, gets stated in some degree on the basis of observed conditions, of objects. The width of the ditch, the slipperiness of the banks, not the mere presence of a ditch, is the trouble. The difficulty is getting located and defined;

it is becoming a true problem, something intellectual, not just an annoyance at being held up in what we are doing. The person who is suddenly blocked and troubled in what he is doing by the thought of an engagement to keep at a time that is near and a place that is distant has the suggestion of getting there at once. But in order to carry this suggestion into effect, he has to find means of transportation. In order to find them he has to note his present position and its distance from the station, the present time, and the interval at his disposal. Thus the perplexity is more precisely located: just so much ground to cover, so much time to do it in.

The word 'problem' often seems too elaborate and dignified to denote what happens in minor cases of reflection. But in every case where reflective activity ensues, there is a process of *intellectualizing* what at first is merely an *emotional* quality of the whole situation. This conversion is effected by noting more definitely the conditions that constitute the trouble and cause the stoppage of action.

The Third Phase, the Guiding Idea, Hypothesis

The first suggestion occurs spontaneously; it comes to mind automatically; it *springs* up; it "pops," as we have said, "into the mind"; it flashes upon us. There is no direct control of its occurrence; the idea just comes or it does not come; that is all that can be said. There is nothing *intellectual* about its occurrence. The intellectual element consists in *what we do with it*, how we use it, *after* its sudden occurrence as an idea. A controlled use of it is made possible by the state of affairs just described. In the degree in which we define the difficulty (which is effected by stating it in terms of objects), we get a better idea of the kind of solution that is needed. The facts or data set the problem before us, and insight into the problem corrects, modifies,

expands the suggestion that originally occurred. In this fashion the suggestion becomes a definite supposition or, stated more technically, a *hypothesis*.

Take the case of a physician examining a patient or a mechanic inspecting a piece of complicated machinery that does not behave properly. There is something wrong, so much is sure. But how to remedy it cannot be told until it is known *what* is wrong. An untrained person is likely to make a wild guess — the suggestion — and then proceed to act upon it in a random way, hoping that by good luck the right thing will be hit upon. So some medicine that appears to have worked before or that a neighbor has recommended is tried. Or the person fusses, monkeys, with the machine, poking here and hammering there on the chance of making the right move. The trained person proceeds in a very different fashion. He *observes* with unusual care, using the methods, the techniques, that the experience of physicians and expert mechanics in general, those familiar with the structure of the organism or the machine, have shown to be helpful in detecting trouble.

The idea of the solution is thus controlled by the diagnosis that has been made. But if the case is at all complicated, the physician or mechanic does not foreclose further thought by assuming that the suggested method of remedy is certainly right. He proceeds to act upon it tentatively rather than decisively. That is, he treats it as a guiding idea, a working hypothesis, and is led by it to make more observations, to collect more facts, so as to see if the *new* material is what the hypothesis calls for. He reasons that *if* the disease is typhoid, *then* certain phenomena will be found; and he looks particularly to see if *just* these conditions are present. Thus both the first and second operations are brought under control; the sense of the problem becomes more adequate and refined and the suggestion ceases

to be a *mere* possibility, becoming a *tested* and, if possible, a *measured* probability.

The Fourth Phase, Reasoning (in the Narrower Sense)

Observations pertain to what exists in nature. They constitute the facts, and these facts both regulate the formation of suggestions, ideas, hypotheses, and test their probable value as indications of solutions. The ideas, on the other hand, occur, as we say, in our heads, in our minds. They not only occur there, but are capable, as well, of great development there. Given a fertile suggestion occurring in an experienced, well-informed mind, that mind is capable of elaborating it until there results an idea that is quite different from the one with which the mind started.

For example, the idea of heat in the third instance in the earlier chapter [8] was linked up with what the person already knew about heat — in his case, its expansive force — and this in turn with the contractive tendency of cold, so that the idea of expansion could be used as an explanatory idea, though the mere idea of heat would not have been of any avail. Heat was quite directly suggested by the observed conditions; water was felt to be hot. But only a mind with some prior information about heat would have reasoned that heat meant expansion, and then used the idea of expansion as a working hypothesis. In more complex cases, there are long trains of reasoning in which one idea leads up to another idea known by previous test to be related to it. The stretch of links brought to light by reasoning depends, of course, upon the store of knowledge that the mind is already in possession of. And this depends not only upon the prior experience and special education of the individual who is carrying on the inquiry, but also upon the state of culture and science of the age and place. Reason-

[8] See page 94.

ing helps extend knowledge, while at the same time it depends upon what is already known and upon the facilities that exist for communicating knowledge and making it a public, open resource.

A physician to-day can develop, by reasoning from his knowledge, the implications of the disease that symptoms suggest to him as probable in a way that would have been impossible even a generation ago; just as, on the other hand, he can carry his observation of symptoms much farther because of improvement in clinical instruments and the technique of their use.

Reasoning has the same effect upon a suggested solution that more intimate and extensive observation has upon the original trouble. Acceptance of a suggestion in its first form is prevented by looking into it more thoroughly. Conjectures that seem plausible at first sight are often found unfit or even absurd when their full consequences are traced out. Even when reasoning out the bearings of a supposition does not lead to its rejection, it develops the idea into a form in which it is more apposite to the problem. Only when, for example, the conjecture that a pole was an index pole had been thought out in its implications could its particular applicability to the case in hand be judged. Suggestions at first seemingly remote and wild are frequently so transformed by being elaborated into what follows from them as to become apt and fruitful. The development of an idea through reasoning helps supply intervening or intermediate terms which link together into a consistent whole elements that at first seemingly conflict with each other, some leading the mind to one inference and others to an opposed one.

Mathematics as Typical Reasoning. Mathematics affords the typical example of how far can be carried the operation of relating ideas to one another, without having to depend

upon the observations of the senses. In geometry we start with a few simple conceptions, line, angle, parallel, surfaces formed by lines meeting, etc., and a few principles defining equalities. Knowing something about the equality of angles made by parallel lines when they intersect a straight line, and knowing, by definition, that a perpendicular to a straight line forms two right angles, by means of a combination of these ideas we readily determine that the sum of the interior angles of a triangle is equal to two right angles. By continuing to trace the implications of theorems already demonstrated, the whole subject of plane figures is finally elaborated. The manipulation of algebraic symbols so as to establish a series of equations and other mathematical functions affords an even more striking example of what can be accomplished by developing the relation of ideas to one another.

When the hypothesis indicated by a series of scientific observations and experiments can be stated in mathematical form, that idea can be transformed to almost any extent, until it assumes a form in which a problem can be dealt with most expeditiously and effectively. Much of the accomplishment of physical science depends upon an intervening mathematical elaboration of ideas. It is not the mere presence of measurements in quantitative form that yields scientific knowledge, but that particular kind of mathematical statement which can be developed by reasoning into other and more fruitful forms — a consideration which is fatal to the claim to scientific standing of many educational measurements merely because they have a quantitative form.

The Fifth Phase, Testing the Hypothesis by Action

The concluding phase is some kind of testing by overt action to give *experimental corroboration,* or *verification,*

of the conjectural idea. Reasoning shows that *if* the *idea* be adopted, certain consequences follow. So far the conclusion is hypothetical or conditional. If when we look we find present all the conditions demanded by the theory, and if we find the characteristic traits called for by rival alternatives to be lacking, the tendency to believe, to accept, is almost irresistible. Sometimes direct observation furnishes corroboration, as in the case of the pole on the boat. In other cases, as in that of the bubbles, experiment is required; that is, *conditions are deliberately arranged in accord with the requirements of an idea or hypothesis to see whether the results theoretically indicated by the idea actually occur.* If it is found that the experimental results agree with the theoretical, or rationally deduced, results, and if there is reason to believe that *only* the conditions in question would yield such results, the confirmation is so strong as to induce a conclusion — at least until contrary facts shall indicate the advisability of its revision.

Of course, verification does not always follow. Sometimes consequences show failure to confirm instead of corroboration. The idea in question is refuted by the court of final appeal. But a great advantage of possession of the habit of reflective activity is that failure is not *mere* failure. It is instructive. The person who really thinks learns quite as much from his failures as from his successes. For a failure indicates to the person whose thinking has been involved in it, and who has not come to it by mere blind chance, what further observations should be made. It suggests to him what modifications should be introduced in the hypothesis upon which he has been operating. It either brings to light a new problem or helps to define and clarify the problem on which he has been engaged. Nothing shows the trained thinker better than the use he makes of his errors and mistakes. What merely annoys and discourages a person not

accustomed to thinking, or what starts him out on a new course of aimless attack by mere cut-and-try methods, is a stimulus and a guide to the trained inquirer.

The Sequence of the Five Phases Is Not Fixed

The five phases, terminals, or functions of thought, that we have noted do not follow one another in a set order. On the contrary, each step in genuine thinking does something to perfect the formation of a suggestion and promote its change into a leading idea or directive hypothesis. It does something to promote the location and definition of the problem. Each improvement in the idea leads to new observations that yield new facts or data and help the mind judge more accurately the relevancy of facts already at hand. The elaboration of the hypothesis does not wait until the problem has been defined and adequate hypothesis has been arrived at; it may come in at any intermediate time. And as we have just seen, any particular overt test need not be final; it may be introductory to new observations and new suggestions, according to what happens in consequence of it.

There is, however, an important difference between test by overt action in practical deliberations and in scientific investigations. In the former the practical commitment involved in overt action is much more serious than in the latter. An astronomer or a chemist performs overt actions, but they are for the sake of knowledge; they serve to test and develop his conceptions and theories. In practical matters, the main result desired lies outside of knowledge. One of the great values of thinking, accordingly, is that it defers the commitment to action that is irretrievable, that, once made, cannot be revoked. Even in moral and other practical matters, therefore, a thoughtful person treats his overt deeds as experimental so far as possible; that is to say,

while he cannot call them back and must stand their consequences, he gives alert attention to what they teach him about his conduct as well as to the non-intellectual consequences. He makes a problem out of consequences of conduct, looking into the causes from which they probably resulted, especially the causes that lie in his own habits and desires.

In conclusion, we point out that the five phases of reflection that have been described represent only in outline the indispensable traits of reflective thinking. In practice, two of them may telescope, some of them may be passed over hurriedly, and the burden of reaching a conclusion may fall mainly on a single phase, which will then require a seemingly disproportionate development. No set rules can be laid down on such matters. The way they are managed depends upon the intellectual tact and sensitiveness of the individual. When things have come out wrong, it is, however, a wise practice to review the methods by which the unwise decision was reached, and see where the misstep was made.

One Phase May Be Expanded

In complicated cases some of the five phases are so extensive that they include definite subphases within themselves. In this case it is arbitrary whether the minor functions are regarded as parts or are listed as distinct phases. There is nothing especially sacred about the number five. For example, in matters of practical deliberation where the object is to decide what to do, it may be well to undertake a scrutiny of the underlying desires and motives that are operating; that is, instead of asking what ends and means will best satisfy one's wish, one may turn back to the attitudes of which the wish is the expression. It is a matter of indifference whether this search be listed as an independent prob-

lem, having its own phases, or as an additional phase in the original problem.

Reference to the Future and to the Past

Again, it has been suggested that reflective thinking involves a look into the future, a forecast, an anticipation, or a prediction, and that this should be listed as a sixth aspect, or phase. As a matter of fact, every intellectual suggestion or idea is anticipatory of some possible future experience, while the final solution gives a definite set toward the future. It is both a record of something accomplished and an assignment of a future method of operation. It helps set up an enduring habit of procedure. When a physician, for example, has diagnosed a case, he usually makes also a *prognosis*, a forecast, of the probable future course of the disease. And not only is his treatment a verification — or the reverse — of the idea or hypothesis about the disease upon which he has proceeded, but the result also affects his treatment of future patients. In some cases, the future reference may be so important as to require special elaboration. In this case, it may be presented as an added, distinct phase. Some of the investigations of an astronomical expedition to watch an eclipse of the sun may be directly intended, for example, to get material bearing on Einstein's theory. But the theory, itself, is so important that its confirmation or refutation will give a decided turn to the future of physical science, and this consideration is likely to be uppermost in the minds of scientists.

Of equal importance is the reference to the *past* involved in reflection. Of course, suggestions are dependent in any case upon one's past experience; they do not arise out of nothing. But while sometimes we go ahead with the suggestion without stopping to go back to the original experience of which it is the fruit, at other times we go consciously

over the past experience in considerable detail as part of the process of testing the value of the suggestion.

For example, it occurs to a man to invest in real estate. Then he recalls that a previous investment of this kind turned out unfortunately. He goes over the former case, comparing it bit by bit with the present, to see how far the two cases are alike or unlike. Examination of the past may be the chief and decisive factor in thought. The most valuable reference to the past is likely, however, to come at the time the conclusion is reached. We noted earlier[4] the importance of a final survey to secure a net formulation of the exact result and of the premises upon which it logically depends. This is not only an important part of the process of *testing*, but, as was stated in the earlier discussion, is almost necessary if good habits are to be built up. Ability to *organize* knowledge consists very largely in the habit of reviewing previous facts and ideas and relating them to one another on a new basis; namely, that of the conclusion that has been reached. A certain amount of this operation is included in the testing phase that has been described. But its influence upon the attitude of students is so important that it may be well at times so to emphasize it that it becomes a definite function, or phase, on its own account.

[4] See page 75.

CHAPTER EIGHT

THE PLACE OF JUDGMENT IN REFLECTIVE ACTIVITY

I. Three Factors in Judging

We have been dealing so far with the act of reflection as an entirety. There are subordinate unities within the process upon whose character the efficiency of the whole undertaking depends.

Judgments, the Constituent Units of Thought

From one point of view the whole process of thinking consists of making a series of judgments that are so related as to support one another in leading to a final judgment — the conclusion. In spite of this fact, we have treated reflective activity as a whole, first, because judgments do not occur in isolation but in connection with the solution of a problem, the clearing away of something obscure and perplexing, the resolution of a difficulty; in short, as units in reflective activity. The purpose of solving a problem determines what kind of judgments should be made. If I were suddenly to announce that it would take twenty-two and a half yards of carpet to cover a certain floor, it might be a perfectly correct statement, but as a *judgment* it would be senseless if it did not bear upon some question that had come up. Judgments need to be *relevant* to an issue as well as correct. Judging is the act of selecting and weighing the bearing of facts and suggestions as they present themselves, as well as of deciding whether the alleged facts are really

facts and whether the idea used is a sound idea or merely a fancy. We may say, for short, that a person of sound judgment is one who, in the idiomatic phrase, has 'horse sense'; he is a good judge of *relative values;* he can estimate, appraise, evaluate, with tact and discernment.

It follows that the heart of a good habit of thought lies in the power to pass judgments *pertinently* and *discriminatingly*. We sometimes meet men with little schooling whose advice is greatly relied upon and who are spontaneously looked to when an emergency arises, men who are conspicuously successful in conducting vital affairs. They are the persons of sound judgment. A man of sound judgment in any set of affairs is an *educated* man as respects those affairs, whatever his schooling or academic standing. And if our schools turn out their pupils in that attitude of mind which is conducive to good judgment in any department of affairs in which the pupils are placed, they have done more than if they sent out their pupils possessed *merely* of vast stores of information or high degrees of skill in specialized branches.

The Features of Judgment

The significant traits of judgment may be gathered from a consideration of the operations to which the word *judgment* was originally applied; namely, the authoritative decision of matters in a legal controversy — the procedure of the *judge on the bench.* There are three such features: (1) a controversy, consisting of opposite claims regarding the same objective situation; (2) a process of defining and elaborating these claims and of sifting the facts adduced to support them; (3) a final decision, or sentence, closing the particular matter in dispute while also serving as a rule or principle for deciding future cases.

It Arises from Doubt and Controversy

1. Unless there is something doubtful, the situation is read off at a glance; it is taken in on sight; *i.e.*, there is merely perception, recognition, not judgment. If the matter is wholly doubtful, if it is dark and obscure throughout, there is a blind mystery and again no judgment occurs. But if it suggests, however vaguely, different meanings, rival possible interpretations, there is some *point at issue*, some *matter at stake*. Doubt takes the form of discussion, of controversy within the mind. Different sides compete for a conclusion in their favor. Cases brought to trial before a judge illustrate neatly and unambiguously this strife of alternative interpretations; but any attempt to clear up intellectually a doubtful situation exemplifies the same traits. A moving blur catches our eye in the distance; we ask ourselves: "What is it? Is it a cloud of whirling dust? a tree waving its branches? a man signaling to us?" Something in the total situation suggests each of these possible meanings. Only one of them can possibly be correct; perhaps none of them is appropriate; yet *some* meaning the thing in question surely has. Which of the alternative suggested meanings has the rightful claim? What does the perception really mean? How is it to be interpreted, estimated, appraised, placed? Every judgment proceeds from some such situation.

It Defines the Issue by Selecting Evidential Facts and Appropriate Principles

2. The hearing of the controversy, the trial, the weighing of alternative claims, divides into two branches, either of which, in a given case, may be more conspicuous than the other. In the consideration of a legal dispute these two branches are sifting the evidence and selecting the rules

that are applicable; they are 'the facts' and 'the law' of the case. In ordinary judgment they are (*a*) the determination of the data that are important in the given case, and (*b*) the elaboration of the conceptions or meanings suggested by the crude data.[1] They are concerned with the two questions: (*a*) What portions or aspects of the situation are significant in controlling the formation of the interpretation? (*b*) Just what is the full meaning and bearing of the idea used as a method of interpretation? These questions are strictly correlative; the answer to each depends upon the answer to the other. We may, however, for convenience, consider them separately.

a. Selecting the Facts. In every actual occurrence there are many details that are part of the total occurrence, but nevertheless are not significant in relation to the point at issue. All parts of an experience are equally present, but they are very far from being equally valuable as signs or as evidences. Nor is there any tag, or label, on any trait saying: "This is important" or "This is trivial." Nor is intensity, or vividness, or conspicuousness a safe measure of indicative and proving value. The glaring thing may be totally insignificant in this particular situation, and the key to the understanding of the whole matter may be modest or hidden. Features that are not significant are distracting; they insist upon their claim to be regarded as clews and cues to interpretation, while traits that are really significant do not appear on the surface at all. Hence, judgment is required *even in reference to the situation* or event that is present to the senses; elimination or rejection, selection, discovery, or bringing to light must take place. Till we have reached a final conclusion, rejection and selection must be tentative or conditional. We select the things

[1] Compare the fourth function in the analysis made in Chapter VII.

that we hope or trust are cues to meaning. But if they do not suggest a situation that accepts and includes them, we reconstitute our data, the facts of the case; for we mean, intellectually, by the facts of the case *those traits that are used as evidence in reaching a conclusion or forming a decision.*

No hard and fast rules for this operation of selecting and rejecting, or fixing upon significant evidential facts, can be given. It all comes back, as we say, to the good judgment, the good sense, of the one judging. To be a good judge is to have a sense of the relative indicative or signifying values of the various features of the perplexing situation; to know what to let go as of no account; what to eliminate as irrelevant; what to retain as conducive to the outcome; what to emphasize as a clew to the difficulty. This power in ordinary matters we call *knack, tact, cleverness;* in more important affairs, *insight, discernment.* In part it is instinctive or inborn, but it also represents the funded outcome of long familiarity with like operations in the past. Possession of this ability to seize what is evidential or significant and to let the rest go is the mark of the expert, the connoisseur, the *judge,* in any matter.

Mill cites the following case, which is worth noting as an instance of the extreme delicacy and accuracy to which may be developed this power of sizing up the significant factors of a situation.

> A Scotch manufacturer procured from England, at a high rate of wages, a working dyer, famous for producing very fine colors, with the view of teaching to his other workmen the same skill. The workman came; but his method of proportioning the ingredients, in which lay the secret of the effects he produced, was by taking them up in handfuls, while the common method was to weigh them. The manufacturer sought to make him turn his handling system into an equivalent weighing system, that the general principles of his pecul-

iar mode of proceeding might be ascertained. This, however, the man found himself quite unable to do, and could therefore impart his own skill to nobody. He had, from individual cases of his own experience, established a connection in his mind between fine effects of color and tactual perceptions in handling his dyeing materials; and from these perceptions he could, in any particular case, *infer the means to be employed* and the effects which would be produced.

Long brooding over conditions, intimate contact associated with keen interest, thorough absorption in a multiplicity of allied experiences, tend to bring about those judgments which we then call 'intuitive'; but they are true judgments, because they are based on intelligent selection and estimation, with solution of a problem as the controlling standard. Possession of this capacity makes the difference between the artist and the intellectual bungler.

Such is ability to judge in its completest form. But in any case there is a certain feeling after the way to be followed; a tentative picking out of certain qualities to see what emphasis upon them would lead to; a willingness to hold final appraisal in suspense; willingness to reject the factors entirely or relegate them to a different position in the evidential scheme if other features yield more solvent suggestions. Alertness, flexibility, curiosity, are the essentials; dogmatism, rigidity, prejudice, caprice, arising from routine, passion, and flippancy, are fatal.

b. Selecting the Principles. This selection of data is, of course, for the sake of controlling the *development and elaboration of the suggested meaning in the light of which they are to be interpreted.*[2] Evolution of conceptions thus goes on simultaneously with determination of the facts; one possible meaning after another is held before the mind, considered in relation to the data to which it is applied, is

[2] Cf. pages 104 and 109.

developed into its more detailed bearings, is dropped or tentatively accepted and used. We do not approach any problem with a wholly naïve or virgin mind; we approach it with certain acquired habitual modes of understanding, with a certain store of previously evolved meanings or at least of experiences from which meanings may be educed.

If a habit is checked, and so inhibited from easy application, a possible meaning for the facts in question comes to the mind. No hard and fast rules decide whether a meaning suggested is the right and proper meaning to follow up. The individual's own good (or bad) judgment is the guide. There is no label, on any given idea or principle, that says automatically, "Use me in this situation" — as the magic cakes of Alice in Wonderland were inscribed "Eat me." The thinker has to decide, to choose; and there is always a risk, so that the prudent thinker selects warily — subject, that is, to confirmation or frustration by later events. If one is not able to estimate wisely what is relevant to the interpretation of a given perplexing or doubtful issue, it avails little that arduous learning has built up a large stock of concepts. For learning is not wisdom; information does not guarantee good judgment. Memory may provide a refrigerator in which to store a stock of meanings for future use, but judgment selects and adopts the one to be used in an emergency — and without an emergency (some crisis, slight or great) there is no call for judgment. No conception, even if it is carefully and firmly established in the abstract, can at first safely be more than a *candidate* for the office of interpreter. Only greater success than that of its rivals in clarifying dark spots, untying hard knots, reconciling discrepancies, can elect it and prove it to be a valid idea for the given situation. In short, thinking is a continual appraising of both data and ideas. Unless the pertinence and force of each seemingly evidential fact

and seemingly explanatory idea is *judged,* appraised, the mind goes on a wild-goose chase.

It Terminates in a Decision

3. The judgment when formed is a *decision;* it closes, or concludes, the question at issue. This determination not only settles that particular case, but it also helps fix a rule or method for deciding similar matters in the future; as the sentence of the judge on the bench both terminates that dispute and also forms a precedent for future decisions. If the interpretation settled upon is not controverted by subsequent events, a presumption is built up in favor of similar interpretation in other cases where the features are not so obviously unlike as to make it inappropriate. In this way, principles of judging are gradually built up; a certain manner of interpretation gets weight, authority. In short, meanings get *standardized;* they become logical concepts.[8]

II. Analysis and Synthesis: The Two Functions of Judgment

Through judging, confused data are cleared up, and seemingly incoherent and disconnected facts are brought together. The clearing up is *analysis.* The bringing together, or unifying, is *synthesis.* Things may have a peculiar feeling for us; they may make a certain indescribable impression upon us: the thing may *feel* round (that is, present a quality which we afterwards define as 'round'); an act may seem rude; yet this impression, this quality, may be lost, absorbed, blended in the total situation. Only as we need to use just that aspect of the original situation as a tool of grasping something perplexing or obscure in another situa-

[8] See page 150.

tion, do we detach the quality so that it becomes individualized. Only because we need to characterize the shape of some new object or the moral quality of some new act, does the element of roundness or rudeness in the old experience detach itself and so stand out as a distinctive feature. If the element thus selected clears up what is otherwise obscure in the new experience, if it settles what is uncertain, it thereby gains in positiveness and definiteness of meaning. This point will meet us again in the following chapter; here we speak of the matter only as it bears upon the question of analysis and synthesis.

Mental Analysis Is Not like Physical Division

Even when it is definitely stated that intellectual and physical analyses are different sorts of operations, intellectual analysis is often treated after the analogy of physical, as if it were the breaking up of a whole into all its constituent parts in the mind instead of in space. As nobody can possibly tell what breaking a whole into its parts in the mind means, this conception leads to the further notion that logical analysis is a mere enumeration and listing of all conceivable qualities and relations. The influence upon education of this conception has been very great.[4] Every subject in the curriculum has passed through — or still remains in — what may be called the phase of 'anatomical' or 'morphological' method: the stage in which understanding the subject is thought to consist of multiplying distinctions of quality, form, relation, and so on, and attaching some name to each distinguished element. In normal growth, specific properties are emphasized and so individualized only when they serve to clear up a present difficulty. Only

[4] Thus arise all those falsely analytic methods in geography, reading, writing, drawing, botany, arithmetic, which we have already considered in another connection. (See page 80.)

as they are involved in judging some specific situation is there any motive or use for analyses, for emphasis upon some element or relation as peculiarly significant.

The same putting the cart before the horse, the product before the process, is found in that overconscious formulation of methods of procedure so current in elementary instruction. The method that is employed in discovery, in reflective inquiry, cannot possibly be identified with the method that emerges *after* the discovery is made.[5] In the genuine operation of inference, the mind is in the attitude of *search*, of *hunting*, of *projection*, of *trying this and that;* when the conclusion is reached, the search is at an end. The Greeks used to discuss: "How is learning (or inquiry) possible? For either we know already what we are after, and then we do not learn or inquire; or we do not know, and then we cannot inquire, for we do not know what to look for." The dilemma is at least suggestive, for it points to the true alternative: the use in inquiry of doubt, of tentative suggestion, of experimentation. After we have reached the conclusion, a reconsideration of the steps of the process to see what is helpful, what is harmful, what is merely useless, assists in dealing more promptly and efficaciously with analogous problems in the future. In this way the method of *organizing* thought is built up.[6]

Conscious Method and Unconscious Logical Attitude

The common assumption that, unless the pupil from the outset *consciously recognizes and explicitly states* the method logically implied in the result he is to reach, he will have *no* method and his mind will work confusedly or anarchically is fallacious. It is equally erroneous to be-

[5] See page 74.

[6] Compare the discussion (pages 77–79) of the psychological and the logical.

lieve that, if he accompanies his performance with conscious statement of some form of procedure (outline, topical analysis, list of headings and subheadings, uniform formula), his mind is safeguarded and strengthened. As a matter of fact, the gradual, largely unconscious, development of *logical attitude and habit* comes first. A conscious setting forth of the method logically adapted for reaching an end is possible only after the result has first been reached by unconscious and tentative methods. Such conscious setting forth of the method is valuable when a review of the method that achieved success in a given case will throw light upon a new similar case. The ability to fasten upon and single out (abstract, analyze) those features of one experience that are logically best is hindered by premature insistence upon their explicit formulation. Repeated use is what gives a *method* definiteness; given this definiteness, precipitation into formulated statement should follow naturally. But because teachers find that the things that they themselves best understand are marked off and defined in clear-cut ways, our schoolrooms are pervaded with the superstition that children are to *begin* with crystallized formulæ of method.

As analysis is conceived to be a sort of picking to pieces, so synthesis is thought to be a sort of physical piecing together. When it is so imagined, it too becomes a mystery. In fact, synthesis takes place wherever we grasp the bearing of facts on a conclusion or of a principle on facts. As analysis is *emphasis,* so synthesis is *placing;* the one causes the emphasized fact or property to stand out as significant; the other puts what is selected in its *context,* its connection with what is signified. It unites it with some other meaning to give both increased significance. When quicksilver was linked to iron, tin, etc., as a *metal,* all these objects obtained new intellectual value. Every judgment is analytic in so far

as it involves discernment, discrimination, marking off the trivial from the important, the irrelevant from what points to a conclusion; and it is synthetic in so far as it leaves the mind with an inclusive situation within which selected facts are placed.

Analysis and Synthesis in Educational Procedure

Educational methods that pride themselves on being exclusively analytic or exclusively synthetic are (so far as they carry out their boasts) incompatible with normal operations of judgment. Discussions have taken place, for example, as to whether the teaching of geography should be analytic or synthetic. The synthetic method is supposed to begin with the partial, limited portion of the earth's surface already familiar to the pupil, and then gradually piece on adjacent regions (the county, the country, the continent, and so on) till an idea of the entire globe is reached, or of the solar system that includes the globe. The analytic method is supposed to begin with the physical whole, the solar system or globe, and to work down through its constituent portions till the immediate environment is reached. The underlying conceptions here deal with physical wholes and physical parts. As a matter of fact, we cannot assume that the portion of the earth already familiar to the child is such a definite object, mentally, that he can safely start with and from his present idea of it. His knowledge of it is misty and vague as well as incomplete. Accordingly, mental progress will involve analysis of *it* — emphasis of features that are significant till they will stand out clearly. Moreover, his own locality is not sharply marked off, neatly bounded, and measured. His experience of it is already an experience that involves sun, moon, and stars as parts of the scene he surveys; it involves a changing horizon line as he moves about. In short, even his more limited and local experience involves

far-reaching factors that take his imagination out beyond his own street and village. Connection, relationship with a larger whole, is already involved. But understanding of these relations is inadequate, vague, incorrect. He needs to define the features of the local environment in order to clarify and enlarge his conceptions of the larger geographical scene to which they belong. At the same time, not till he has grasped the larger scene will many of even the commonest features of his local environment become intelligible. Analysis leads to synthesis, while synthesis perfects analysis. As the pupil grows in comprehension of the vast complicated earth in its setting in space, he also sees more definitely the meaning of familiar local details. This intimate interaction between selective emphasis and interpretation through a context of what is selected is found wherever reflection proceeds normally. Hence the folly of trying to set analysis and synthesis over against each other.

Whenever we appraise, we both select and emphasize a particular quality or feature, and we link together things that, from an intellectual point of view, were previously separate. In appraising the value of land, the appraiser not only causes its monetary property to stand out, but he also places it in a scale of the land values of the whole community. Something of this sort happens in all judgment.

CHAPTER NINE

UNDERSTANDING: IDEAS AND MEANINGS

I. Ideas as Suggestions and Conjectures

We see something moving, hear a sound unexpectedly, smell an unusual odor, and we ask: What is it? What does what we see, hear, smell, *mean?* When we have found out what it signifies, a squirrel running, two persons conversing, an explosion of gunpowder, we say that we *understand.* To understand is to grasp meaning. Until we understand, we are, if we have curiosity, troubled, baffled, and hence moved to inquire. After we understand, we are, comparatively at least, intellectually at home. There is a time during our investigation when meaning is only suggested; when we hold it in suspense as a possibility rather than accept it as an actuality. Then the meaning is an *idea.* An idea thus stands midway between assured understanding and mental confusion and bafflement. While a meaning is *conditionally* accepted, accepted for use and trial, it is an idea, a supposal. When it is *positively* accepted, some object or event is understood.

Ideas Are Elements in Judgments, Tools of Interpretation

An idea is thus not a unity like judgment, but rather a unit element in forming a judgment. We may compare a complete reflection to a paragraph; then the judgment is like a sentence in the structure of the paragraph, and an idea is like a word in the sentence. That ideas are necessary

constituents of inference, we have already seen. Positive inference can be deferred and kept in process of development and test only while a meaning is *not* asserted and believed in. Moreover, ideas are indispensable to inference because they direct observations and regulate the collection and inspection of data. Without a guiding idea, facts would be heaped up like grains of sand; they would not be organized into intellectual unity. In discussing ideas we are not, accordingly, introducing a new topic, but are, as in the discussion of judgment, going into detail regarding an element in the whole already considered.

Let us take the instance of a blur in motion at a distance. We wonder what the *thing is;* that is, what the *blur means.* A man waving his arms, a friend beckoning to us, are suggested as possibilities. To accept at once either alternative is to arrest judgment. But if we treat what is suggested as only a suggestion, a supposition, a possibility, it becomes an idea, having the following traits: (*a*) As merely a suggestion, it is a conjecture, a guess, which in cases of greater dignity we call a 'hypothesis' or a 'theory.' That is to say, it is *a possible, but as yet doubtful, mode of interpretation.* (*b*) Even though doubtful, it has an office to perform; namely, that of directing inquiry and examination. If this blur means a friend beckoning, then careful observation should show certain other traits. If it is a man driving unruly cattle, certain other traits should be found. Let us look and see if these traits are found. Taken merely as a doubt, an idea would paralyze inquiry. Taken merely as a certainty, it would arrest inquiry. Taken as a doubtful possibility, it affords a standpoint, a platform, a method of inquiry.

Ideas, then, are not genuine ideas unless they are tools with which to search for material to solve a problem. Suppose it is desired that the pupil grasp *the idea* of the spheric-

ity of the earth. This is different from teaching him its sphericity *as a fact*. He may be shown (or reminded of) a ball or a globe and be told that the earth is round like those things; he may then be made to repeat that statement day after day till the shape of the earth and the shape of the ball are welded together in his mind. But he has not thereby acquired an *idea* of the earth's sphericity; at most, he has had a certain image of a sphere and has finally managed to image the earth after the analogy of his ball image. To grasp 'sphericity' as an idea, the pupil must first have realized certain confusing features in observed facts and have had the idea of spherical shape suggested to him as a possible way of accounting for such phenomena as tops of masts being seen at sea after the hulls have disappeared, the shape of shadows of the earth in an eclipse, etc. Only by use as a method of interpreting data so as to give them fuller meaning does sphericity become a genuine idea. There may be a vivid image and no idea; or there may be a fleeting, obscure image and yet an idea, if that image performs the function of instigating and directing the observation and relation of facts.

Logical ideas are like keys that are shaped with reference to opening a lock. Pike, separated by a glass partition from the fish upon which they ordinarily prey, will — so it is said — butt their heads against the glass until it is literally beaten into them that they cannot get at their food. Animals learn (when they learn at all) by a 'cut-and-try' method, by doing at random first one thing then another thing and continuing the things that happen to succeed. This procedure is followed by human beings when they do not operate on the basis of ideas, when they 'monkey,' to use a term derived from the random activity of one of the most intelligent of the lower animals. Action directed consciously by ideas — by suggested meanings accepted for

the sake of experimenting with them — is the sole alternative both to bull-headed stupidity and to learning bought from that dear teacher — chance experience.

It is significant that many words for intelligence suggest the idea of circuitous, evasive activity — often with a sort of intimation of even moral obliquity. The bluff, hearty man goes straight (and stupidly, it is implied) at some work. The intelligent man is cunning, shrewd (crooked), wily, subtle, crafty, artful, designing — the idea of indirection is involved.[1] An idea is a method of evading, circumventing, or surmounting through reflection obstacles that otherwise would have to be attacked by brute force. But ideas may lose their intellectual quality because of habitual use. When a child was first learning to recognize, in some hesitating suspense, cats, dogs, houses, marbles, trees, shoes, and other objects, ideas — conscious and tentative meanings — intervened as methods of identification. Now, as a rule, the thing and the meaning are so completely fused that there is no idea proper, but only automatic recognition. On the other hand, things which are so familiar, so known already, that they are recognized without an intervening idea may appear in an unusual context and give rise to a problem that necessitates intermediate ideas in order that the object be understood. For example, a person drawing a room will be compelled to form a new idea of the corner of the room formed by the meeting of two walls and the ceiling, since now that corner has to be represented on a plane surface. A child has practical familiarity with squares and spheres in the context of daily life, as shapes of toys and utensils. But when they present themselves in a definitely geometrical connection, he is obliged to use mental effort to form ideas of them.

[1] See Ward, *Psychic Factors of Civilization*, p. 153.

Ideas Are Logical Instruments, Not Psychic Compounds

It will be noted that an idea in its logical significance is something quite different from ideas as they are often treated in psychological texts. An idea, logically speaking, is not a faded perception of an object, nor is it a compound of a number of sensations. You would not get the peculiar meaning that is attached to, say, ' chair ' by having a mental picture of one. A savage might be able to form an image of poles and wires, and a layman of a complex scientific diagram. But unless the savage knew something about telegraphy, he would have no idea, or at least no correct idea, of the poles and wires, while the most accurate mental reproduction of the diagram would leave the layman totally without understanding of its meaning, and hence without an idea of it, even though he could list all *its* qualities one by one. The fact is that an idea, intellectually, cannot be defined by its structure, but only by its function and use. Whatever in a doubtful situation or undecided issue helps us to form a judgment and to bring inference to a conclusion by means of anticipating a possible solution is an idea, and nothing else is. It is an idea because of what it *does* in clearing up a perplexity or in harmonizing what is otherwise fragmentary, not because of its psychical make-up.

II. Things and Meanings

An idea normally terminates in giving understanding, so that an event or thing acquires meaning. A thing understood, a thing with a meaning, is different from both an idea, which is a doubtful and still unattached meaning, and from a mere brute, physical thing. I can stumble against something in the dark and get hurt without any understand-

ing of what the thing is. So far, it is *merely* a thing, a something or other. If I get a light and investigate, I learn that the thing is a stool, or a coalhod, or a log of firewood. Now it is a *known* object, a thing understood, a thing with a meaning — all three being synonymous expressions.

To Understand Is to Grasp Meaning

If a person comes suddenly into your room and calls out "Paper," various alternatives are possible. If you do not understand the English language, there is simply a noise that may act as a physical stimulus or irritant. But the noise is not an intellectual object; it does not have intellectual value. It is the mere brute thing just spoken of. If, first, the cry is the usual accompaniment of the delivery of the morning paper, the sound will have meaning, intellectual content; you will understand it. Or if, second, you are eagerly awaiting the receipt of some important document, you may assume that the cry means an announcement of its arrival. If, third, you understand the English language, but no context suggests itself from your habits and expectations, the *word* has meaning, but not the whole event. You are then perplexed and incited to think out, to hunt for, some explanation of the apparently meaningless occurrence. If you find something that accounts for the performance, it gets meaning; you come to understand it. As intelligent beings, we presume the existence of meaning, and its absence is an anomaly. Hence, if it should turn out that the person merely meant to inform you that there was a scrap of paper on the sidewalk, or that paper existed somewhere in the universe, you would think him crazy or yourself the victim of a stupid joke. To grasp the meaning of a thing, an event, or a situation is to see it in its *relations* to other things: to note how it operates or functions, what consequences follow from it, what causes it, what uses it can be put to. In

contrast, what we have called the brute thing, the thing without meaning to us, is something whose relations are not grasped.

Since all knowing, including all scientific inquiry, aims at clothing things and events with meaning — at understanding them, — it always proceeds by taking the thing inquired into out of its isolation. Search is continued until the thing is discovered to be a related part in some larger whole. Thus a piece of rock may be understood by referring it to a sedimentary stratum known to have been formed under certain conditions, or a suddenly appearing light in the heavens may be understood when identified as the return of Halley's comet. Suppose that the rock has peculiar markings on it. They may be contemplated purely esthetically, as curiosities. But they may arouse inquiry. If so, the resulting investigation will have for its purpose the removal of the apparent isolation, the non-connectedness, of the markings. Finally, they are explained as glacial scratches. They no longer stand alone. They have been brought into connection with a past era of the earth's history in which great masses of slow-moving ice descended into regions now temperate, carrying with them grit and rocks that ground and scratched other rocks imbedded in place.

Interaction of Two Modes of Understanding

In these illustrations two types of grasp of meaning have been exemplified. When the English language is understood, the person grasps at once the meaning of 'paper.' He may not, however, see any meaning or sense in the performance as a whole. Similarly, the person identifies the object on sight as a stone; there is no secret, no mystery, no perplexity, about that. But he does not understand the markings on it. They have some meaning, but what is it? In one case, owing to familiar acquaintance, the thing and its meaning,

up to a certain point, are one; in the other, the thing and its meaning are, temporarily at least, sundered, and meaning has to be sought in order to understand the thing. In one case understanding is direct, prompt, immediate; in the other, it is roundabout and delayed.

Most languages have two sets of words to express these two modes of understanding; one for the direct taking in or grasp of meaning, the other for its circuitous apprehension, thus: γνῶναι and εἰδέναι in Greek; *noscere* and *scire* in Latin; *kennen* and *wissen* in German; *connaître* and *savoir* in French; while in English *to be acquainted with* and *to know of or about* have been suggested as equivalents.[2] Now, our intellectual life consists of a peculiar interaction between these two types of understanding. All judgment, all reflective inference, presupposes some lack of understanding, a partial absence of meaning. We reflect in order that we may get hold of the full and adequate significance of what happens. Nevertheless, *something* must be already understood, the mind must be in possession of some meaning that it has mastered, or else thinking is impossible. We think in order to grasp meaning, but none the less every extension of knowledge makes us aware of blind and opaque spots, where with less knowledge all had seemed obvious and natural. A scientist brought into a new district will find many things that he does not understand, while the native savage or rustic will be wholly oblivious to any meanings beyond those directly apparent. Some Indians brought to a large city remained stolid at the sight of mechanical wonders of bridge, trolley, and telephone, but were

[2] James, *Principles of Psychology*, vol. I, p. 221. To *know* and to *know that* are perhaps more precise equivalents; compare "I know him" and "I know *that* he has gone home." The former expresses a fact simply; for the latter, evidence might be demanded and supplied.

held spellbound by the sight of workmen climbing poles to repair wires. Increase of the store of meanings makes us conscious of new problems, while only through translation of the new perplexities into what is already familiar and plain do we understand or solve these problems. This is the constant spiral movement of knowledge.

Intellectual Progress a Rhythm

Our progress in genuine knowledge always consists *in part in the discovery of something not understood in what had previously been taken for granted as plain, obvious, matter-of-course, and in part in using meanings that are directly grasped as instruments for getting hold of obscure and doubtful meanings.* No object is so familiar, so obvious, so commonplace that it may not unexpectedly present, in a novel situation, some problem, and thus arouse reflection in order to understand it. No object or principle is so strange, peculiar, or remote that it may not be dwelt upon till its meaning becomes familiar — taken in on sight without reflection. We may come to *see, perceive, recognize, grasp, seize, lay hold of* principles, laws, abstract truths — *i.e.*, to understand their meaning in an immediate fashion. Our intellectual progress consists, as has been said, in a rhythm of direct understanding — technically called *ap*prehension — with indirect, mediated understanding — technically called *com*prehension.

III. The Process by Which Things Acquire Meaning

The first problem that comes up in connection with direct understanding is how a store of directly recognized meanings is built up. How do we learn to view things on sight as significant members of a situation or as having, as a matter of course, specific meanings? Our chief difficulty in answer-

ing this question lies in the thoroughness with which the lesson of familiar things has been learned. Thought can more easily traverse an unexplored region than it can undo what has been so thoroughly done as to be ingrained in unconscious habit. We apprehend chairs, tables, books, trees, horses, clouds, stars, rain, so promptly and directly that it is hard to realize that once these objects were mere brute things, as alien to our understanding as the sounds of the Choctaw language would be if we now suddenly heard them.

Vague Wholes Are Antecedent to Understanding

In an often quoted passage, Mr. James has said: "The baby, assailed by eyes, ears, nose, skin, and entrails at once, feels it all as one great blooming, buzzing confusion." [3] Mr. James is speaking of a baby's world taken as a whole; the description, however, is equally applicable to the way any new thing strikes an adult, so far as the thing is really new and strange. To the traditional 'cat in a strange garret,' everything is blurred and confused; the usual marks that label things so as to separate them from one another are lacking. Foreign languages that we do not understand always seem jabberings, babblings, in which it is impossible to fix a definite, clear-cut, individualized group of sounds. The countryman in the crowded city street, the landlubber at sea, the ignoramus in sport at a contest between experts in a complicated game, are instances. Put an unexperienced man in a factory, and at first the work seems to him a meaningless medley. All strangers of another race proverbially look alike to the visiting foreigner. Only gross differences of size or color are perceived by an outsider in a flock of sheep, each of which is perfectly individualized to the shepherd. A diffusive blur and indiscriminate shifting characterize what we do not understand. The problem of the

[3] *Principles of Psychology*, vol. I, p. 488.

acquisition of meaning by things, or (stated in another way) of forming habits of simple apprehension, is thus the problem of introducing (*a*) *definiteness*, or *distinction* and (*b*) *consistency, coherence, constancy*, or *stability* of meaning into what is otherwise vague and wavering.

Practical Responses Clarify the Vague

The acquisition of definiteness and of consistency of meanings is derived primarily from practical activities. By rolling an object, the child makes its roundness appreciable; by bouncing it, he singles out its elasticity; by lifting it, he makes weight its conspicuous distinctive factor. Not through the senses, but by means of the reaction, the responsive adjustment, is an impression given a character marked off from qualities that call out unlike reactions. Children, for example, are usually quite slow in apprehending differences in color. Differences from the standpoint of the adult so glaring that it is impossible not to note them are recognized and recalled by the young with great difficulty. Doubtless colors do not all *feel* alike, but there is no intellectual recognition of what constitutes the difference. The redness or greenness or blueness of the object does not call out a reaction that is sufficiently peculiar to give prominence or distinction to the color trait. Gradually, however, certain characteristic habitual responses associate themselves with certain things; the white becomes the sign, say, of milk and sugar, to which the child reacts favorably; blue becomes the sign of a dress that the child likes to wear, and so on; and the distinctive reactions tend to single out color qualities from other things in which they had been submerged.

Take another example. We have little difficulty in distinguishing from one another rakes, hoes, plows and harrows, shovels and spades. Each has its own associated characteris-

tic use and function. A student of botany or chemistry may have, however, great difficulty in recalling the difference between serrate and dentate, ovoid and obovoid, in the shapes and edges of leaves, or between acids in *ic* and in *ous*. There is some difference; but just what? Or, he knows what the difference is; but which is which? Variations in form, size, color, and arrangement of parts have much less to do, and the uses, purposes, and functions of things and of their parts much more to do, with distinctness of character and meaning than we should be likely to think. What misleads us is the fact that the qualities of form, size, color, and so on, are *now* so distinct that we fail to see that the problem is precisely to account for the way in which they originally obtained their definiteness and conspicuousness. As long as we sit passive before objects, they are not distinguished out of the vague blur that swallows them all. Differences in the pitch and intensity of sounds leave behind a different feeling, but until we assume different attitudes toward them, or *do* something special in reference to them, their vague difference cannot be *intellectually* gripped and retained.

Illustrations from Drawing and Language

Children's drawings afford a further exemplification of the same principle. Perspective does not exist, for the child's interest is not in *pictorial representation*, but in the *values* of the things represented; and while perspective is essential to the former, it is no part of the characteristic use and function of the things themselves. The house is drawn with transparent walls, because the rooms, chairs, beds, people inside, are the important things in the house-meaning; smoke always comes out of the chimney — otherwise, why have a chimney at all? At Christmas time, the stockings may be drawn almost as large as the house or even so large that they have to be put outside of it — in any case, it is

the scale of values in use that furnishes the scale for their qualities. The drawings are diagrammatic reminders of these values, not impartial records of physical and sensory qualities. One of the chief difficulties felt by most persons in learning the art of pictorial representation is that habitual uses and results of use have become so intimately read into the character of things that it is practically impossible to shut them out at will.

The acquiring of meaning by sounds, in virtue of which they become words, is perhaps the most striking illustration that can be found of the way in which mere sensory stimuli acquire definiteness and constancy of meaning and are thereby themselves defined and interconnected for purposes of recognition. Language is a specially good example because there are hundreds or even thousands of words in which meaning is now so thoroughly consolidated with physical qualities as to be directly understood. In the case of words it is easier to recognize that this connection has been gradually and laboriously acquired than in the case of physical objects, such as chairs, tables, buttons, trees, stones, hills, flowers, and so on, where it seems as if the union of intellectual meaning with physical fact were aboriginal. It now seems to be thrust upon us rather than acquired through active explorations. But in the case of the meaning of words, we see readily that it is by making sounds and noting the results that follow, by listening to the sounds of others and watching the activities that accompany them, that a given sound finally becomes the stable bearer of a meaning.

Meaning and Context

In the case of the meaning of words, we are aware by watching children and by our own experience in learning French or German that happenings, like sounds, which

originally were devoid of significance acquire meaning by use, and that this use always involves a *context*. With children just learning to understand and use speech, the context is largely that of objects and acts. A child associates *hat* with putting something on his head when he is going outdoors; *drawer* with pulling something out of a table, etc. Single words, because of the direct presence of a context of actions performed with objects, then have the force that complete sentences have to an older person. Gradually other words that originally gained meaning by use in a context of overt actions become capable of supplying the context, so that the mind can dispense with the context of things and deeds. Speaking in sentences marks obviously a *linguistic* gain. But the more important matter is that it shows a person has made a great *intellectual* advance. He can now think by putting together verbal signs of things that are not present to the senses and are not accompanied by any overt actions on his part. As he understands similar combinations made by others, he has a new resource that extends his otherwise narrow personal experience indefinitely. When he learns to read, arbitrary marks on paper acquire meaning for him, and he gains possession of the means of still further extending his experience so as to include what others, far remote from him in space and time, have experienced.

As was indicated a short time ago, it is not easy to grasp the fact that things had at first no significance in our experience, and that significance was acquired in their case, as in that of sounds, by entering into a context of use, by bringing help and enjoyment to us — articles of food, furniture, and wearing apparel, — or by bringing harm and suffering — like fire approached too closely, pins that scratch, hammers that hit fingers instead of nails.

Take, for example, a little spark of light appearing at night in the heavens, and compare the original mere sight of it with the discriminating and extensive knowledge of it that the expert astronomer has. He identifies it, say, as planet, asteroid, stellite, or fixed star that is the sun of some other system. Each one of these things carries an immense store of meanings with it — distance, rate of movement, chemical composition, indeed all the things that one finds in a bulky volume upon astronomy. The change from a mere spark to an immensely significant object illustrates the acquisition of meaning which has taken place in the case of everything that we understand or know. It illustrates also the fact that the acquisition of ability to understand (which is the same as the acquisition of significance by things) is immensely furthered by language and by elaboration of a series of meanings [4] and through reasoning. This latter process is itself dependent upon possession of some kind of linguistic sign system — for we must remember that mathematical symbols are also a kind of language.

The Means-Consequence Relation and Its Educational Significance

We may sum up by stating that things gain meaning when they are used as *means to bring about consequences* (or as means to prevent the occurrence of undesired consequences), or as standing for *consequences* for which we have to discover *means*. The relation of *means-consequence* is the center and heart of all understanding. The operations by which things become understood as chairs, tables, shoes, hats, food, illustrate the means-consequence relation from the 'means' side. The relation beginning with the 'consequence,' or result-sought, side is illustrated in any invention. Edison thought of producing light by the use of elec-

[4] See page 112.

tricity; he then had to discover the conditions of things and relations that would produce it — the means for it. The same obtained with Langley and the Wright brothers after they conceived the idea, as a desired end, of a machine to fly in the air. It is illustrated in all cases of ordinary planning. We think of something needful or desirable, and then we have to seek out materials and methods for bringing it to pass. Every time we have to solve a problem of this kind, things enter into the means-consequence relation and in doing so take on added meaning, just as carbon filaments obtained a new significance through the production of electric light, and as gasoline, once almost a waste by-product, secured new meaning when the internal-combustion engine was invented.

The educational bearing of this principle is almost too obvious for mention. One of the chief causes for failure in school to secure that gain in ability to understand that is a precious educational result is the neglecting to set up the conditions for active use as a means in bringing consequences to pass — the neglecting to provide projects that call out the inventiveness and ingenuity of pupils in proposing aims to realize, or finding means to realize, consequences already thought of. All routine and all externally dictated activity fail to develop ability to understand, even though they promote skill in external doing. Too many so-called ' problems,' in reality assigned tasks, call at best simply for a kind of mechanical dexterity in applying set rules and manipulating symbols. In short, there is a challenge to understanding only when there is either a desired consequence for which means have to be found by inquiry, or things (including symbols in the degree in which experience has matured) are presented under conditions where reflection is required to see what consequences can be effected by their use.

It is assumed too frequently that subject matter is understood when it has been stored in memory and can be reproduced upon demand. The net outcome of our discussion is that nothing is really known except in so far as it is understood.

CHAPTER TEN

UNDERSTANDING: CONCEPTION AND DEFINITION

I. The Nature of Conceptions

In the preceding chapter we discussed meaning from two points of view, and we suggested a third aspect of it that we shall consider more fully in this chapter. The two aspects that were discussed were (1) meaning as doubtful, as a hypothetical possibility; in short as an *idea* (which, as was pointed out, is not a mere psychological complex but is an object or situation that has a status of being *supposed* instead of being accepted), and (2) meaning as a property of things and events. It was shown in that connection how things *acquire* meaning and how finally meaning is so consolidated with a thing that we do not dream of separating the thing from its significance.

They Are Established Meanings

The aspect of meaning that was indicated in passing is the fact that an idea, after it has been used as a guide to observation and action, may be confirmed and so acquire an accepted status on its own behalf. Afterwards it is employed, not tentatively and conditionally, but with assurance as an instrumentality of understanding and explaining things that are still uncertain and perplexing. These established meanings, taken to be secure and warranted, are *conceptions*. They are means of judgment because they are *standards of reference*. They may be best described as ' standard-

ized meanings.' Every common noun that is familiar and so well understood in itself that it can be used to judge other things expresses a concept. Table, stone, sunset, grass, animal, moon, and on through the list of common nouns that are solid and dependable, are concepts in their meaning. We see an object that looks strange; we are told that it is the kind of bed used by a certain folk. The thing in question is no longer unfamiliar in meaning; to us its significance is settled.

They Enable Us to Generalize

Concepts enable us to *generalize,* to extend and carry over our understanding from one thing to another. If we know what ' bed ' means in general, we at least can tell what *kind* or what *sort* of thing the individual thing is. It is plain that conceptions, since they represent the whole class or set of things, economize our intellectual efforts tremendously. Sometimes of course we are especially interested in the peculiar traits of an object, in what is unique about it, what makes it an *individual.* But for practical purposes it is often enough to know what *kind* of thing it is; knowing that fact, we can bring into play the habits of thought and behavior that belong to every member of the entire class. The concept calls into play whatever is appropriate to a large number of cases previously known, thus freeing thought from preoccupation with finding out what *this* is.

They Standardize Our Knowledge

Conceptions *standardize* our knowledge. They introduce solidity into what would otherwise be formless, and *permanence* into what would otherwise be shifting. If pounds arbitrarily changed their weight and foot rules their length while we were using them, weighing and measuring would, obviously, amount to nothing. What would it signify to say

that a piece of cloth was a yard and a half wide, or that a bulk of sugar weighed twenty pounds? The standard of reference must remain the same to be of any use. The concept signifies that a meaning has been stabilized and remains the same in different contexts. Sometimes when persons are discussing a controversial matter, the argument gets confused and the debaters misled because, as they go along, they unconsciously shift the meanings of the terms they use. Reflection and new discoveries may, to be sure, change the meaning of an old concept, just as people may change from the foot-pound system of measurement to the metric system. But they should know what they are about and deliberately note that they are using a changed meaning unless they are to get hopelessly mixed up.

When persons are said to have come to an understanding with each other, it is meant that they have arrived at an *agreement* or *settlement* of some affair or issue that has been under discussion between them. This fact indicates that standardized and stable meanings are a condition of effective communication. When two persons speak languages that are not mutually understood, they can still communicate to some extent, provided there are gestures which have *identical meanings for both parties*. Indeed, the social necessity of meanings that are the same for two persons in spite of differences in their experiences and their conditions of life is one of the chief forces in standardizing meanings. After they are socially stabilized, an individual has the ability to keep his own thinking steady because some of his thoughts remain constant in what they refer to; 'chair' always signifies the same; so do 'sun,' 'water,' 'earth,' etc. Each of our entire list of common nouns always refers to the same objects, in spite of differences of place, time, and other conditions of experience.

They Help Identify the Unknown and Supplement the Sensibly Present

Stating the matter somewhat differently, conceptions, or standard meanings, are instruments of (*a*) identification, (*b*) supplementation, and (*c*) placing an object in a system. Suppose a little speck of light hitherto unseen is detected in the heavens. Unless there is a store of meanings to fall back upon in reasoning, that speck of light will remain just what it is to the senses — a mere speck of light. For all that it leads to intellectually, it might as well be a mere irritation of the optic nerve. Given, however, the stock of meanings built up in prior experience, this speck of light is mentally attacked by means of appropriate concepts. Does it indicate asteroid, or comet, or a new-forming sun, or a nebula resulting from some cosmic collision or disintegration? Each of these conceptions has its own specific and differentiating characters, which are then sought for by minute and persistent inquiry. As a result, then, the speck is identified, we will say, as a comet. Through a standard meaning it gets identity and stability of character. Supplementation then takes place. All the known qualities of comets are read into this particular thing, even though they have not been as yet observed. All that the astronomers of the past have learned about the paths and structure of comets becomes available capital with which to interpret the speck of light. Finally, this comet-meaning is, itself, not isolated; it is a related portion of the whole system of astronomic knowledge. Suns, planets, satellites, nebulæ, comets, meteors, star dust — all these conceptions have a certain mutuality of reference and interaction, and when the speck of light is identified as meaning a comet, it is at once adopted as a full member in this vast kingdom of beliefs.

Darwin, in an autobiographical sketch, says that when

a youth he told the geologist, Sidgwick, of finding a tropical shell in a certain gravel pit. Thereupon Sidgwick said it must have been thrown there by some person, adding: "But if it were really embedded there, it would be the greatest misfortune to geology, because it would overthrow all that we know about the superficial deposits of the Midland Counties" — since these were glacial. And then Darwin adds: "I was then utterly astonished at Sidgwick not being delighted at so wonderful a fact as a tropical shell being found near the surface in the middle of England. Nothing before had made me thoroughly realize *that science consists in grouping facts so that general laws or conclusions may be drawn from them.*" This instance (which might, of course, be duplicated from any branch of science) indicates how scientific notions make explicit the systematizing tendency involved in all use of concepts.

The Educational Significance of Concepts

It follows that it would be impossible to overestimate the educational importance of arriving at conceptions: that is, of meanings that are *general* because applicable in a great variety of different instances in spite of their difference; that are constant, uniform, or self-identical in what they refer to, and that are standardized, known points of reference by which to get our bearings when we are plunged into the strange and unknown.

Young children cannot of course acquire and employ the same conceptions that persons of riper experience use. But at *every* stage of development, each lesson, in order to be educative, should lead up to a certain amount of conceptualizing of impressions and ideas. Without this conceptualizing or intellectualizing, nothing is gained that can be carried over to the better understanding of new experiences. The *deposit* is what counts, educationally speaking. No amount

of transient interest, however absorbing and exciting it may be, can compensate for failure to achieve an intellectual deposit.

The very importance of concepts has led, however, to great mistakes in the conduct of teaching. What we earlier termed the false use of the 'logical'[1] had its roots in the belief that somehow definite and general meanings, or concepts, can be presented to pupils and absorbed by them *ready-made,* thus promoting the rapidity and efficiency of acquisition of knowledge. In consequence, failure to observe the conditions that are essential for the formation of conceptions left most pupils with only *verbal* formulæ. Concepts were often presented that were so remote from the understanding and experience of students as to be positively confusing in their artificiality.

The reaction of education in experimental schools against the arbitrary imposition of indigestible material has often, however, been a reaction to the opposite extreme. A variety of worth-while experiences and activities with real materials is introduced, but pains are not taken to make sure that the activities terminate in that which makes them *educationally* worth while, as distinct from an agreeable passing of the time — namely, the achievement of a fairly definite *intellectualization* of the experience. This intellectualization is the deposit of an *idea* that is both definite and general. Education in its intellectual aspect and getting an idea from what is experienced are synonymous. What does having an experience amount to unless, as it ceases to exist, it leaves behind an increment of meaning, a better understanding of something, a clearer future plan and purpose of action: in short, an idea? With respect to teaching there is no more important topic than the question of the way in which genuine concepts are formed. To that question we now turn.

[1] See page 79.

II. How Conceptions Arise

They Are Not Formed by Extracting Common Traits from Ready-Made Objects

It is convenient in discussing this question to begin with the negative side, with the mistaken character of some current beliefs about the way in which conceptions come into existence. They are *not* derived by taking a number of things, each of which is already well understood and definite in meaning, and then comparing them one with another, point by point, till all different qualities are excluded and there remains a core of what is common to all. The origin of concepts is sometimes described to be as if a child began with a lot of different particular things, say particular dogs: his own Fido, his neighbor's Carlo, his cousin's Tray. Having all these different objects before him, he analyzes them into a lot of different qualities, say (*a*) color, (*b*) size, (*c*) shape, (*d*) number of legs, (*e*) quantity and quality of hair, (*f*) foods eaten, and so on; and then strikes out all the unlike qualities (such as color, size, shape, hair), retaining traits, such as quadruped and domesticated, which they all have in common.

They Begin with Experiences

As a matter of fact, the child begins with whatever significance he has got out of some one dog he has seen, heard, and played with. He carries over from his experience of this one object to his subsequent experiences expectations of characteristic modes of behavior: he expects them before they show themselves. He assumes this attitude of anticipation whenever an object gives him any excuse for it. Thus he may call cats 'little dogs' or horses 'big dogs.' But finding

that other expected traits and modes of behavior are not fulfilled, he is forced to throw out certain traits from the dog-meaning, while by contrast some other traits are selected and emphasized. As he further applies the meaning to other animals, the dog-meaning gets still further defined and refined. He does not begin with a lot of ready-made objects from which he extracts a common meaning; he tries to apply in every new experience whatever result of his old experience will help him understand and deal with it.

They Become More Definite with Use

It is not true that the child's idea of each individual dog is clear and definite to begin with, and that his own dog is perceived by him with its full equipment of distinct qualities. Rather his original idea of Fido is vague and pulpy, wavering, as long as Fido is the only dog (and much more so if the only animal) he knows. By observing the family cat, he is led to discriminate the particular qualities that characterize each of them. As he makes acquaintance with other animals, the horse, pig, etc., the definite properties that belong to a dog are still further demarcated. Thus, even without much comparison with other *dogs*, a dog concept is gradually built up. In just the extent to which he is aware of the qualities that make his Fido a *dog*, rather than a cat, horse, or any other animal, he has a standardized point of reference for assimilating and sorting out other animals as he makes acquaintance with them. During the whole process he has been trying to fit his idea, vague or definite according to his stage of experience, on all animals that are at all similar to dogs, applying it when he can, becoming aware of differences whenever it won't fit. By these processes, his idea gets body, steadiness, distinction; it becomes a concept.

They Become General with Use

By the same processes, a vague, more or less formless idea acquires *generality*. Conceptions, that is to say, are general because of use and application, not because of their ingredients. The view that a conception originates in an impossible sort of analysis has its counterpart in the idea that it is made up out of all the like elements that remain after dissection of a number of individuals. Not so; the moment a meaning is gained, it is a working tool of further apprehensions, an instrument of understanding other things. Thereby the meaning is *extended* as well as defined. Generality resides in application to the comprehension of new cases, not in the constituent parts of a notion. A collection of traits left as the common residuum, the *caput mortuum*, of a million objects, would be merely a collection, an inventory or aggregate, not a *general idea*. Any striking trait emphasized in an experience that afterward serves as an aid in understanding some other experience becomes, in virtue of that application, in so far general.

What has just been said may be compared with the earlier statements about analysis and synthesis.[2] The analysis that results in giving an idea the solidity and definiteness of a concept is simply emphasis upon that which gives a clew for dealing with some uncertainty. If a child identifies a dog seen at a distance by the way in which the animal wags its tail, then that particular trait, which may never have been *consciously* singled out before, becomes distinct — it is analyzed out of its vague submergence in the animal as a whole. The only difference between such a case and the analysis effected by a scientific inquirer in chemistry or botany is that the latter is alert for clews that will serve for the purpose of sure identification in the *widest pos-*

[2] See pages 127–129.

sible area of cases; he wants to find the signs by which he can identify an object as one of a definite kind or class even should it present itself under very unusual circumstances and in an obscure and disguised form. The idea that the selected trait is already plain to the mind and then is merely isolated from other traits equally definite puts the cart before the horse. It is selection as evidence or as a clew that gives a trait distinctness it did not possess before.

Synthesis is the operation that gives extension and generality to an idea, as analysis makes the meaning distinct. Synthesis is correlative to analysis. As soon as any quality is definitely discriminated and given a special meaning of its own, the mind at once looks around for other cases to which that meaning may be applied. As it is applied, cases that were previously separated in meaning become assimilated, identified, in their significance. They now belong to the same *kind* of thing. Even a young child, as soon as he masters the meaning of a word, tries to find occasion to use it; if he gets the idea of a cylinder, he sees cylinders in stove pipes, logs, etc. In principle this is not different from Newton's procedure in the story about the origin in his mind of the concept of gravitation. Having the idea suggested by the falling of an apple, he at once extended it in imagination to the moon as something also tending to fall towards the earth, and then to the movements of the planets in relation to the sun, to the movement of the ocean in the tides, etc. In consequence of this application of an idea that was discriminated, made definite in some one case, to other events, a large number of phenomena that previously were believed to be disconnected from one another were integrated into a consistent system. In other words, there was a comprehensive synthesis.

It would be a great mistake, however, as just indicated, to confine the idea of synthesis to important cases like New-

ton's generalization. On the contrary, when any one carries over any meaning from one object to another object that had previously seemed to be of a different kind, synthesis occurs. It is synthesis when a lad associates the gurgling that takes place when water is poured into what he had thought was an empty bottle with the existence and pressure of air; when he learns to interpret the siphoning of water and the sailing of a boat in connection with the same fact. It is synthesis when things themselves as different as clouds, meadow, brook, and rocks are so brought together as to be composed into a picture. It is synthesis when iron, tin, and mercury are conceived to be of the same kind in spite of individual differences.

III. Definition and Organization of Meanings

The Harmful Consequences of Vagueness

A being that cannot understand at all is at least protected from *mis*-understandings. But beings that get knowledge by means of inferring and interpreting, by judging what things signify in relation to one another, are constantly exposed to the danger of *mis*-apprehension, *mis*-understanding, *mis*-taking — taking of a thing amiss. A constant source of misunderstanding and mistake is indefiniteness of meaning. Because of vagueness of meaning we misunderstand other people, things, and ourselves; because of ambiguity we distort and pervert. Conscious distortion of meaning may be enjoyed as nonsense; erroneous meanings, if clear-cut, may be followed up and got rid of. But vague meanings are too gelatinous to offer matter for analysis and too pulpy to afford support to other beliefs. They evade testing and responsibility. Vagueness disguises the unconscious mixing together of different meanings, and fa-

cilitates the substitution of one meaning for another, and covers up the failure to have any precise meaning at all. It is the aboriginal logical sin — the source from which flow most bad intellectual consequences. Totally to eliminate indefiniteness is impossible; to reduce it in extent and in force requires sincerity and vigor.

Meaning as Intension and as Extension

To be clear or perspicuous, a meaning must be detached, single, self-contained, homogeneous as it were, throughout. The technical name for any meaning that is thus individualized is *intension*. The process of arriving at such units of meaning (and of stating them when reached) is *definition*. The intension of the terms 'man,' 'river,' 'honesty,' 'supreme court,' is the meaning that *exclusively* and *characteristically* attaches to those terms. This meaning is set forth in *definition* of these units of meaning.

The test of the distinctness of a meaning is that it successfully marks off a group of things that exemplify the meaning from other groups, especially from those objects that convey nearly allied meanings. The river-meaning (or character) must serve to *designate* the Rhone, the Rhine, the Mississippi, the Hudson, the Wabash, in spite of their varieties of place, length, quality of water; and must be such as *not* to suggest ocean currents, ponds, or brooks. This use of a meaning to mark off and group together a variety of distinct existences constitutes its *extension*.

As definition sets forth intension, so division (or the reverse process, classification) expounds extension. Intension and extension, definition and division, are clearly correlative; in language previously used, *intension* is meaning as a principle of identifying particulars; extension is the group of particulars identified and distinguished. Meaning, as extension, would be wholly in the air or unreal, did it not point

to some object or group of objects; while objects would be as isolated and independent intellectually as they seem to be spatially, were they not bound into groups or classes on the basis of characteristic meanings they suggest and exemplify in a uniform way.

Together, definition and division put us in possession of definite meanings and also indicate the group of objects to which they refer, the *kind* of things indicated and its various subclasses. They typify the fixation and the organization of meanings. In the degree in which the meanings of any set of experiences are so cleared up as to serve as principles for grouping those experiences in relation to one another, that set of particulars becomes a science; *i.e.*, definition and classification are the marks of a science, as distinct from unrelated heaps of miscellaneous information and from habits that introduce coherence into our experience without our being aware of their operation.

Three Types of Definitions

Definitions are of three types, *denotative, expository, scientific.* Of these, the first and third are logically important, while the expository type is socially and pedagogically important as an intervening step.

a. Denotative. A blind man can never have an adequate understanding of the meaning of *color* and *red;* a seeing person can acquire the knowledge only by having certain things designated in such a way as to fix attention upon some of their qualities. This method of delimiting a meaning by calling out a certain attitude toward objects may be called *denotative,* or *indicative.* It is required for all sense qualities — sounds, tastes, colors — and equally for all emotional and moral qualities. The meanings of 'honesty,' 'sympathy,' 'hatred,' must be grasped by having them presented in an individual's first-hand experience. The reaction of

educational reformers against linguistic and bookish training has always taken the form of demanding recourse to personal experience. However advanced the person is in knowledge and in scientific training, understanding of a new subject, or of a new aspect of an old subject, must always be through acts of experiencing directly or in imagination the existence of the quality in question.

b. Expository. Given a certain store of meanings that have been directly or denotatively marked out, language becomes a resource by which imaginative combinations and variations may be built up. A color may be defined to one who has not experienced it as lying between green and blue; a tiger may be defined (*i.e.*, the idea of it made more definite) by selecting some qualities from known members of the cat tribe and combining them with ideas of size and weight derived from other objects. Illustrations are of the nature of expository definitions; so are the accounts of meanings given in a dictionary. By taking better-known meanings and associating them, the attained store of meanings of the community in which one resides is put at one's disposal. But in themselves these definitions are second-hand and conventional; there is danger that instead of inciting one to effort after personal experiences that will exemplify and verify them, they will be accepted on authority as *substitutes* for direct observation and experiment.

c. Scientific. Even popular definitions serve as rules for identifying and classifying individuals, but the purpose of such identifications and classifications is mainly practical and social, not intellectual. To conceive the whale as a fish does not interfere with the success of whalers, nor does it prevent recognition of a whale when seen, while to conceive it not as a fish but as a mammal serves the practical end equally well, and also furnishes a much more valuable principle for scientific identification and classification. Popular

definitions select certain fairly obvious traits as keys to classification. Scientific definitions select *conditions of causation, production, and generation* as their characteristic material. The traits used by the popular definition do not help us to understand why an object has its common meanings and qualities; they simply state the fact that it does have them. Causal and genetic definitions settle on the way an object is constructed as giving the key to its belonging to a certain *kind* of objects. They explain why it has its class or common traits on the basis of its manner of production.

If, for example, a layman of considerable practical experience were asked what he meant or understood by *metal*, he would probably reply in terms of the qualities useful in recognizing any given metal and in the arts. Smoothness, hardness, glossiness, and brilliancy, heavy weight for its size, would probably be included in his definition, because such traits enable us to identify specific things when we see and touch them; the serviceable properties of capacity for being hammered and pulled without breaking; of being softened by heat and hardened by cold, of retaining the shape and form given, of resistance to pressure and decay, would probably be included — whether or not such terms as 'malleable' or 'fusible' were used. Now a scientific conception, instead of using, even with additions, traits of this kind, determines meaning on a different basis. The present definition of metal is about like this: Metal means any chemical element that enters into combination with oxygen so as to form a base; *i.e.*, a compound that combines with an acid to form a salt. This scientific definition is founded, not on directly perceived qualities nor on directly useful properties, but on the *way in which certain things are causally related to other things; i.e.*, it denotes a relation. As chemical concepts become more and more those of relationships of interaction in constituting other substances, so physical

concepts express more and more relations of operation: mathematical, functions of dependence and order of grouping; biological, relations of differentiation of descent, effected through adjustment of various environments; and so on through the sphere of the sciences. In short, our conceptions attain a maximum of definite individuality and of generality (or applicability) in the degree to which they show how things depend upon one another or influence one another, instead of expressing the qualities that objects possess statistically. The ideal of a system of scientific conceptions is to attain continuity, freedom, and flexibility of transition in passing from any fact and meaning to any other; this demand is met in the degree in which we lay hold of the dynamic ties that hold things together in a continuously changing process — a principle that gives insight into mode of production or growth.

CHAPTER ELEVEN

SYSTEMATIC METHOD: CONTROL OF DATA AND EVIDENCE

I. Method as Deliberate Testing of Facts and Ideas

Judgment, understanding, conception are all of them constituents of the reflective process in which a perplexing, confused, unsettled situation is transformed into one that is coherent, clear, and decided or settled. In discussing them we have introduced nothing new in principle but have amplified what was illustrated in the three cases set forth in Chapter VI and analyzed in some detail in Chapter VII. We shall now return to the original account and utilize the added knowledge we have obtained to discuss the method of reflective activity when it is regulated in a technical and elaborate way. We saw in the first section of Chapter VI that reflection is an operation in which facts on one side and meaning on the other are elicited through constant interaction with each other. Each newly discovered fact develops, tests, and modifies an idea, and every new idea and new shade of an idea lead to further inquiry, which brings to light new facts, modifying our understanding of facts previously observed.

The discussion in which we are now engaging accordingly has two sides. One side concerns method as it operates in gathering and testing the *data* that form the evidence upon which an inference must rest to be properly supported — method of control of observation and memory, which supply the facts upon which inference proceeds. The other side

concerns the formation and development of method as it operates in arriving at the *ideas* that are used to interpret the data, to solve problems, and to elaborate and apply concepts. The two functions, as we have seen, accompany each other. The improved selection and discrimination of pertinent data gives a better clew to ideas that are fruitful when employed and to the tests to which they must be submitted. The improvement of ideas in turn stimulates the performance of new observations and the collection of new data.

The Need for Systematized Method

Method of a systematic sort is required in order to safeguard the operations by which we move from one to the other, from facts to ideas, and back again from ideas to the facts that will test them. Without adequate method a person grabs, as it were, at the first facts that offer themselves; he does not examine them to see whether they are truly facts or whether, even though they be real facts, they are relevant to the inference that needs to be made. On the other side, we are given to jumping at the first solution that occurs to us, accepting it as a conclusion without examination and test. We are given also to generalizing an idea far beyond support by evidence. We extend it to new cases without careful study to see whether these cases may not be so different as not to justify the generalization. Method is particularly needed in complex cases and cases of generalization, in order to safeguard us from falling into these errors.

We shall first give an illustration of the way in which the discovery of relevant facts on which to base, and by which to support and test, an inferred solution goes on in company with the formation and use of ideas to interpret the facts.

A man who has left his room in order finds it upon his

return in a state of confusion, articles being scattered at random. Automatically, the notion comes to his mind that burglary would account for the disorder. He has not seen the burglars; their presence is not a fact of observation; it is a thought, an idea. The state of the room is a *fact*, certain, speaking for itself; the presence of burglars is a possibility that may explain the facts. Moreover, the man has no special burglar in mind. The state of his room is perceived and is particular, definite — exactly as it is; a burglar is inferred. But no particular individual is thought of; merely some indefinite, unspecified, member of a class.

The original fact, the room as it is first observed, does not by any means *prove* the fact of burglary. The latter conjecture may be correct, but evidence to justify accepting it positively is lacking. The total 'fact' as given contains both too much and too little; too much, because there are many features in it that are irrelevant to inference, that are therefore *logically* superfluous. Too little, because the considerations that are crucial — that, if they were ascertained, would be decisive — do not appear on the surface. Thoughtful search for the *kind* of facts that are clews is therefore necessitated. If the illustration were followed out beyond the judgment as to whether there had been a burglary to the question of who the criminal was and how he was to be discovered and the crime brought home to him, the need for extensive and careful examination of the fact side of the case would be even clearer.

Observation Valuable When Guided by Hypotheses

This search needs guidance. If it is conducted purely at random a multitude of facts will be turned up, but they will be so unrelated that their very number will add to the difficulty of the case. It is quite possible for thinking to be swamped by the mere multiplicity and diversity of facts.

The real problem is: What facts are *evidence* in this case? The search for evidential facts is best conducted when some suggested *possible* meaning is used as a guide in exploring facts, especially in instituting a hunt for some fact that would point conclusively to one explanation and exclude all others. So the person entertains various hypotheses. Besides burglary, there is the possibility that some member of the family had an urgent need to find some article and, being in a hurry, had not taken the time to put things in order again. There are children also in the family, and they are not above mischief on occasion. Each of these conjectured possibilities is developed to some extent. *If* it were a burglar, or an adult in a hurry, or mischief on the part of children, *then* certain features characteristic of each particular cause would be present. *If* it were a case of burglary, *then* articles of value would be missing. Guided by this idea, the person looks again, not any longer at the scene as a whole, but analytically, with reference to this one item. He finds jewelry gone; he finds that some silver articles have been twisted and bent, and left behind as merely plated wear. These data are incompatible with any hypothesis except burglary. Looking further, he finds data that are most naturally interpreted to mean that a window has been tampered with — a fact consistent only with the action of a burglar. Under any ordinary circumstances these data would give adequate evidence of the visit of a burglar; if the conditions were very unusual, there would be nothing but to continue thinking of further possibilities and looking for further facts as data by which to test them. The instance is taken from ordinary life. Scientific method represents the same sort of thing carried on with greater elaborateness, by means especially of instruments and apparatus devised for the purpose and of mathematical calculations.

II. The Importance of Method in Judging Data

From what has been said it is clear that the formation of the idea or hypothesis that is employed to interpret data and to unify them into a coherent situation is indirect. Fundamentally, suggestions just occur or do not occur, depending, as we have seen, on the state of culture and knowledge at the time; upon the discernment and experience and native genius of the individual; upon his recent activities; to some extent upon chance; for many of the most pregnant inventions and discoveries have come about almost accidentally, although these happy accidents never happen except to persons especially prepared by interest and prior thought. But while the original happening of a suggestion, whether it be brilliant or stupid, is not *directly* controlled, the acceptance and use of the suggestion is capable of control, given a person of a thoughtful habit of mind.

The primary method of control is that indicated in the illustration. The person who is confronted with the situation that has to be thought through returns upon, revises, extends, analyzes, and makes more precise and definite the facts of the case. He strives to convert them into just those data which will test the suggestions that occur to mind. This testing will take place, as in the burglary incident, by finding upon examination traits that are *incompatible* with some suggested possibility and consistent with some other. They are just what *should* be there in fact *if* that particular hypothesis is correct. The ideal of course is discovery of traits that could be present *only* upon a particular hypothesis. This type of evidence can rarely be found in fact, but it is approximated by the methods of control of observation and collection of data that have been found to work well in scientific inquiry.

The Interrelations of Observation and Thought

It will be noted, then, that observation is not an operation that is opposed to thought or that is even independent of it. On the contrary, *thoughtful* observing is at least one half of thinking, the other half being the entertaining and elaboration of multiple hypotheses. Features that are glaringly conspicuous often need to be ignored; hidden traits need to be brought to light; obscure characteristics to be emphasized and cleared up.

Consider, for example, how a physician makes his diagnosis, his interpretation. If he is scientifically trained, he suspends — postpones — reaching a conclusion in order that he may not be led by superficial occurrences into a snap judgment. There are some facts that are given in an obvious way to his observation. But what is obvious may be, *when regarded as an evidential sign,* most misleading; the evidential facts, the real data, may show themselves only after a prolonged search involving artificial apparatus and a technique that expresses the methods found useful by a whole body of experts.

Conspicuous phenomena may forcibly suggest typhoid, but the physician avoids a conclusion or even any strong preference for this or that conclusion until he has both greatly *enlarged* the scope of his data and also rendered them more *minute*. He not only questions the patient as to his feelings and as to his acts prior to the disease, but by various manipulations with his hands (and with instruments made for the purpose) brings to light a large number of facts of which the patient is quite unaware. The state of temperature, respiration, and heart action is accurately noted, and their fluctuations from time to time are exactly recorded. Until this examination has worked *out* toward a wider collection and *in* toward a minuter scrutiny of details, inference is deferred.

Regulative Features of Scientific Method

Scientific method includes, in short, *all the processes by which the observing and amassing of data are regulated with a view to facilitating the formation of explanatory conceptions and theories.* These devices are all directed toward selecting the precise facts to which weight and significance shall attach in forming suggestions or ideas. Specifically, this selective determination involves operations of (1) elimination by analysis of what is likely to be misleading and irrelevant, (2) emphasis of the important by collection and comparison of cases, and (3) deliberate construction of data by experimental variation.

Elimination of Irrelevant Meanings

1. It is a common saying that one must learn to discriminate between observed facts and judgments based upon them. Taken literally, such advice cannot be carried out; in every observed thing there is — if the thing have any meaning at all — some consolidation of meaning with what is sensibly and physically present, such that, if this were entirely excluded, what is left would have no sense. A says: "I saw my brother." The term *brother,* however, involves a relation that cannot be sensibly or physically observed; it is inferential in status. If A contents himself with saying, "I saw a man," the factor of classification, of intellectual reference, is less complex, but still exists. If, as a last resort, A were to say, "Anyway, I saw a colored object," some relationship, though more rudimentary and undefined, still subsists. Theoretically, it is possible that no object was there, only abnormal nerve stimulation. None the less, the advice to discriminate what is observed from what is inferred is sound practical advice. Its working import is that one should eliminate or exclude *those* inferences as to which experience has shown that there is greatest liability to

error. This, of course, is a relative matter. Under ordinary circumstances no reasonable doubt would attach to the observation, "I see my brother"; it would be pedantic and silly to resolve this recognition back into a more elementary form. Under other circumstances it might be a perfectly genuine question as to whether A saw even a colored *thing*, or whether the color was due to a stimulation of the sensory optical apparatus (like 'seeing stars' upon a blow) or to a disordered circulation. In general, the scientific man is one who knows that he is likely to be hurried to a conclusion and that part of this precipitancy is due to certain habits that tend to make him 'read' certain meanings into the situation that confronts him, so that he must be on the lookout against errors arising from his interests, habits, and current preconceptions.

The technique of scientific inquiry thus consists in various processes that tend to exclude over-hasty 'reading in' of meanings; devices that aim to give a purely 'objective,' unbiased rendering of the data to be interpreted. Flushed cheeks usually mean heightened temperature; paleness means lowered temperature. The clinical thermometer records automatically the actual temperature and hence checks up the habitual associations that might lead to error in a given case. All the instrumentalities of observation — the various -meters and -graphs and -scopes — fulfil a part of their scientific rôle in helping to eliminate meanings supplied because of habit, prejudice, the strong momentary preoccupation of excitement and anticipation, and by the vogue of existing theories. Photographs, phonographs, kymographs, actinographs, seismographs, plethysmographs, and the like, moreover, give records that are permanent, so that they can be employed by different persons, and by the same person in different states of mind; *i.e.*, under the influence of varying expectations and dominant beliefs. Thus purely personal

prepossessions (due to habit, to desire, to after-effects of recent experience) may be largely eliminated. In ordinary language, the facts are *objectively*, rather than *subjectively*, determined. In this way tendencies to premature interpretation are held in check.

Collection of Sufficient Instances

2. Another important method of control consists in the multiplication of cases or instances. If I doubt whether a certain handful gives a fair sample or one representative, for purposes of judging value, of a whole carload of grain, I take a number of handfuls from various parts of the car and compare them. If they agree in quality, well and good; if they disagree, we try to get enough samples so that when they are thoroughly mixed the result will be a fair basis for an evaluation. This illustration represents roughly the value of that aspect of scientific method that insists upon multiplying observations instead of basing the conclusion upon one or a few cases.

So prominent, indeed, is this aspect of method at a certain stage of its development that it is frequently treated as constituting induction. It is supposed that all controlled inference as to matters of fact is based upon collecting and comparing a number of like cases. Actually such comparison and collection is a secondary development within the process of securing a correct conclusion in some single case. If a man infers from one sample of grain as to the grade of wheat of the car as a whole, it is induction and, under certain circumstances, namely, if the entire bulk has been thoroughly mixed, it is a *sound* induction. Other cases are resorted to simply for the sake of rendering a suggested inference more guarded, and more probably correct. In like fashion, the reasoning that led up to the burglary idea in the instance already cited, the particulars upon which the

general meaning (or relation) of burglary was grounded, were simply the sum total of the unlike items and qualities that made up the one case examined. Had this case presented very great obscurities and difficulties, recourse might *then* have been had to examination of a number of similar cases. But this comparison would not introduce scientific method into a process that was not previously of that character; it would only render inference more wary and adequate. *The object of bringing into consideration a multitude of cases is to facilitate the selection of the evidential or significant features upon which to base inference in some single case.*

Unlikeness as Important as Likeness in These Instances

Accordingly, points of *unlikeness* are as important as points of *likeness* among the cases examined. *Comparison,* without *contrast,* does not amount to anything logically. In the degree in which other cases observed or remembered merely duplicate the case in question, we are no better off for purposes of inference than if we had permitted our single original fact to dictate a conclusion. In the case of various samples of grain, it is the fact that samples are *different,* at least as to the place of the carload from which they are taken, that is important. Were it not for this difference, likeness in quality would be of no avail in controlling inference.[1] If we are endeavoring to get a child to regulate his conclusions about the germination of a seed by taking into account a number of instances, very little is gained if the conditions in all these instances closely approximate one another. But if one seed is placed in pure sand, another in loam, and another on blotting paper, and if in each case there

[1] In terms of the phrases used in logical treatises, the so-called 'methods of agreement' (comparison) and 'difference' (contrast) must accompany each other or constitute a 'joint method' in order to be of logical use.

are two conditions, one with and another without moisture, the unlike factors tend to throw into relief the factors that are significant (or 'essential') for reaching a conclusion. Unless, in short, the observer takes care to have the differences in the observed cases as extreme as conditions allow, and unless he notes unlikenesses as carefully as likenesses, he has no way of determining the evidential force of the data that confront him.

Another way of bringing out this importance of unlikeness is the emphasis put by the scientist upon *negative* cases — upon instances that, it would seem, ought to fall into line but that, as a matter of fact, do not. Anomalies, exceptions, things that agree in most respects but disagree in some crucial point, are so important that many of the devices of scientific technique are designed purely to detect, record, and impress upon memory contrasting cases. Darwin remarked that, so easy is it to pass over cases that oppose a favorite generalization, he had made it a habit, not merely to hunt for contrary instances, but also to write down any exception he noted or thought of — as otherwise it was almost sure to be forgotten.

Experimental Variation of Conditions

3. We have already touched upon this factor of control of method, the one that is the most important of all wherever it is feasible. Theoretically, one sample case *of the right kind* will be as good a basis for an inference as a thousand cases; but cases of the right kind rarely turn up spontaneously. We have to search for them, and we may have to *make* them. If we take cases just as we find them — whether one case or many cases — they contain much that is irrelevant to the problem in hand, while much that is relevant is obscure, hidden. The object of experimentation is the *construction, by regular steps taken on the basis of a plan*

thought out in advance, of a typical, crucial case, a case formed with express reference to throwing light on the difficulty in question. All methods on the fact side rest, as already stated,[2] upon regulation of the conditions of observation and memory; experiment is simply the most adequate regulation of these conditions that is possible. We try to make the observation such that every factor entering into it, together with the mode and the amount of its operation, may be open to recognition. Making observations open, overt, precise, constitutes experiment.

Three Advantages of Experiment. Such observations have many and obvious advantages over observations — no matter how extensive — with respect to which we simply wait for an event to happen or an object to present itself. Experiment overcomes defects due to (*a*) the *rarity,* (*b*) the *subtlety* and minuteness (or the violence), and (*c*) the rigid *fixity* of facts as we ordinarily experience them. The following quotations from Jevons's *Elementary Lessons in Logic* bring out all these points:

> We might have to wait years or centuries to meet accidentally with facts which we can readily produce at any moment in a laboratory; and it is probable that most of the chemical substances now known and many excessively useful products would never have been discovered at all by waiting till nature presented them spontaneously to our observation.

This quotation refers to the infrequency, or rarity, of certain facts of nature, even very important ones. The passage then goes on to speak of the minuteness of many phenomena that makes them escape ordinary experience:

> Electricity doubtless operates in every particle of matter, perhaps at every moment of time; and even the ancients could

[2] See page 106.

not but notice its action in the loadstone, in lightning, in the Aurora Borealis, or in a piece of rubbed amber. But in lightning electricity was too intense and dangerous; in the other cases it was too feeble to be properly understood. The science of electricity and magnetism could only advance by getting regular supplies of electricity from the common electric machine or the galvanic battery and by making powerful electromagnets. Most, if not all, the effects which electricity produces must go on in nature, but altogether too obscurely for observation.

Jevons then deals with the fact that, under ordinary conditions of experience, phenomena that can be understood only by seeing them under varying conditions are presented in a fixed and uniform way.

Thus carbonic acid is only met in the form of a gas, proceeding from the combustion of carbon; but when exposed to extreme pressure and cold, it is condensed into a liquid, and may even be converted into a snowlike solid substance. Many other gases have in like manner been liquefied or solidified, and there is reason to believe that every substance is capable of taking all three forms of solid, liquid, and gas, if only the conditions of temperature and pressure can be sufficiently varied. Mere observation of nature would have led us, on the contrary, to suppose that nearly all substances were fixed in one condition only, and could not be converted from solid into liquid and from liquid into gas.

Many volumes would be required to describe in detail all the methods that investigators have developed in various subjects for analyzing and restating the facts of ordinary experience so that we may escape from capricious and routine suggestions and may get the facts in such a form and in such a light (or context) that exact and far-reaching explanations may be suggested in place of vague and limited

ones. But these various devices of inductive inquiry all have one goal in view: the indirect regulation of the function of suggestions, or formation of ideas; and, in the main, they will be found to reduce to some combination of the three types of selecting and arranging subject matter just described.

CHAPTER TWELVE

SYSTEMATIC METHOD: CONTROL OF REASONING AND CONCEPTS

I. The Value of Scientific Conceptions

We have already called attention to the fact that control of observation and memory so as to select and give proper weight to data as evidence depends upon the possession of a store of standardized meanings, or conceptions. If, in the case of the disordered room, the person did not have in hand fairly definite conceptions of burglary, mischief, etc., he would have been as much at a loss in interpreting the scene that met his eyes as a little child would have been. Conceptions are the intellectual instrumentalities that are brought to bear upon the material of sense perception and of recollection in order to clarify the obscure, to bring order into seeming conflict, and unity into the fragmentary. In the case of the physician's diagnosis, dependence upon the fund of already possessed knowledge is even more evident as well as complete. It is an old story that we know *with* what we already know or have mastered intellectually. And 'achieved understanding,' 'established and solid meaning,' and 'conception' are synonymous terms. Hence the necessity for the regulated control of their formation.

The Basic Importance of System in Concepts

We dealt previously with the way in which conceptions come into existence. We have now to consider the method by which a secure serial development of conceptions, one

leading to another in regular sequence, is brought about. The important consideration here is the basic importance of relations between conceptions, of *system*.[1]

A concept may be excellent for the purpose of identifying events that frequently recur in our experience, even if it is not placed in a system or related body of concepts. Thus a person can identify a given four-legged animal as a dog, even though the concept of 'dog' is not part of a system of concepts such as forms the science of zoölogy. But there are other problems of animal life that cannot possibly be solved by the everyday conception of 'dog,' problems that require a serial order of concepts: wolf-family, vertebrate, mammal, and a knowledge of the relations of mammal to birds, reptiles, etc.

The importance of the connections that bind concepts together into a whole is indicated by the words that we use to express the relation of premises and conclusions to each other. (1) The premises are called grounds, foundations, bases, and are said to underlie, uphold, support the conclusion. (2) We 'descend' from the premises to the conclusion, and 'ascend' in the opposite direction — as a river may be continuously traced from source to sea or *vice versa*. So the conclusion springs, flows, or is drawn from its premises. (3) The conclusion — as the word itself implies — closes, shuts in, locks up together the various factors stated in the premises. We say that the premises 'contain' the conclusion, and that the conclusion 'contains' the premises, thereby marking our sense of the inclusive and comprehensive unity in which the elements of reasoning are bound tightly together.

Popular concepts, like the ordinary one of a dog, are based on fairly obvious qualities, qualities that anyone having the normal use of his senses can readily perceive. But these

[1] See page 112.

popular concepts do not take us very far; they are extended or generalized to include cases outwardly different only with great risk. They are responsible for such generalizations as calling a bat a 'bird,' and a whale a 'fish.' They not only lead us astray, but they also stop far short of such generalizations as those that are basic and almost commonplace in science — electron, atom, molecule, mass, energy, etc. And it is this latter kind of concept that furthers discovery, invention, and the control of the forces of nature.

Value of the Concepts of Quantity

One of the great conquests of natural science has been effected by the development of mathematical concepts in a form applicable to observation and interpretation of natural events. Take for example the concepts of quantity and measurement. We can unite from the point of view of the popular concept such qualities as red, green, blue, etc., by bringing them together in the concept of color. But we can make much more exact and extensive inferences regarding color when we use the concept of rates of vibration. We can then relate color phenomena to other events apparently of a totally different kind — infra-red and ultra-violet, radio-active phenomena, sound, electro-magnetism, etc. Through the use of the concepts of quantity we can ignore the differences of quality which mark off things from one another and hence arrest inference. Consequently we can go from one fact to another to an almost indefinite extent if we treat them all as exhibiting measured differences of quantity.

Distinctive Standard Concepts Established in Each Science

Every branch of science, geology, zoölogy, chemistry, physics, astronomy, as well as the different branches of mathematics, arithmetic, algebra, calculus, etc., aims at establishing its own specialized set of concepts that are

keys to understanding the phenomena that are classified in each field. In this way there is provided for every typical branch of subject matter a set of meanings and principles so closely interknit that any one implies some other, according to definite conditions, that, under certain other conditions, implies another, and so on. In this way, substitutions of equivalent meanings are possible, and reasoning, without having recourse to specific observations, can trace out very remote consequences of any principle that is suggested. Definition, general formulæ, and classification are the devices by which the fixation of a meaning and its elaboration into its ramifications are carried on. They are not ends in themselves — as they are frequently regarded even in elementary education — but instrumentalities for facilitating understanding, aids to the interpretation of the obscure and the explanation of the puzzling. Moreover, a conception that, in the form in which it first presents itself, is not applicable to the situation may have implied meanings that are readily applicable — as the rise of water or mercury in a vacuum is explained by developing the implications of weight and of the fact that air has weight. Again, the original concept may be quite limited in its application, while energy will be conserved if the implied ideas traced out by reasoning have wider application than the original idea had.

Playing with Concepts

To the specialist, conceptual meanings become a subject matter of their own. It is an intellectual satisfaction to develop them in their logical relations of interdependence, of implication, without any reference at all to their immediate or even ulterior application to actual existence. To the trained mathematician, for example, nothing is more fascinating than to follow out the relations of concepts and, by discovering unexpected relations among them, see them un-

fold into a harmonious system whose contemplation gives great esthetic satisfaction. There is such a thing as *playing with ideas*.

It is possible for this form of sport to become much more absorbing than is playing games with things. No one, it is safe to say, has ever become distinguished as a thinker in any field of science or philosophy who did not have an absorbing interest in the relations of ideas for their own sake. Many children are much more capable of playing with ideas (provided they are within the range of their understanding) than is usually believed. Constraint arising from external imposition dulls this power and often turns into concealed daydreaming and fantasy-building what, under happier circumstances, would be an interest in connecting meanings with one another and a delight in coming upon unexpected combinations. One of the great values of creative work, as in writing, painting, or any art, is that it promotes a constructive, although unconscious, playing with meanings in their relations.

Need of Final Test of Concepts

Although conceptions are capable of development without reference to direct observation, and although the habit of tracing their connection with one another as just ideas or meaning is absolutely indispensable to the growth of science and to high personal intellectual cultivation, yet the final test lies in the data furnished by experimental observation. Elaboration by reasoning may make a suggested idea very rich and very plausible, but it will not settle the validity of that idea. Only when facts are observed (by methods either of collection or of experimentation) that agree in detail and without exception with theoretical results, are we justified in accepting the rational conclusion as a conclusion that is valid for actual things. Thinking, in short, must end

as well as begin in the domain of concrete observations if it is to be complete thinking. And the ultimate educative value of all deductive processes is measured by the degree to which they become working tools in the creation and development of new experiences.

II. Significant Applications to Education: Characteristic Inadequacies

Some of the points that have been made may be clinched by considering their bearing upon instruction and learning. We shall go back to the statement made earlier [2] about the correlative character of fact and meaning, observation and conception. For most of the educational mistakes about concepts, definition, and generalization result from making a false separation between facts and meanings. In this separation, 'facts' become a dead weight of undigested, mechanical, largely verbal, so-called 'information,' while ideas become so remote from objects and acts of experience that they are empty. Instead of being means for better understanding, they become themselves incomprehensible mysteries, which for some unexplained reason haunt the schoolroom but do not belong anywhere else.

Isolation of Facts from Meaning

In some school subjects and in many topics and lessons, pupils are immersed in mere details. Their minds are loaded with disconnected piecemeal items that are accepted on hearsay or authority. They may even be drawn from observation in so-called 'object-lessons' if what is observed stands as an isolated thing, and no attempt is made to interpret it by placing it in relation to what it does, how it was caused, and what it stands for. It is not enough to load

[2] See page 104.

the memory with statement of facts and laws and then hope that later in life by some magic the mind will find a use for them. Even general principles, when merely memorized, stand on the same level as bare particular facts. Since they are not used either in understanding actual objects and events or in giving rise, through what they imply, to other conceptual meanings, they are, to the mind that memorizes them (falsely called *learning*), mere arbitrary items of information.

In laboratory instruction in higher education as well as in object lessons in elementary education, the subject is often so treated that the student fails to " see the forest on account of the trees." Things and their qualities are retailed and detailed, without reference to a more general character that they stand for and mean. In the laboratory the student becomes engrossed in the processes of manipulation, irrespective of the reason for their performance, without recognizing a typical problem for the solution of which they afford the appropriate method. Only deduction or reasoning brings out and emphasizes consecutive relationships, and only when *relationships* are held in view does learning become more than a miscellaneous scrap bag.

Failure to Follow Up by Reasoning

Again, the mind is allowed to hurry on to a vague notion of the whole of which the fragmentary facts are portions, without any attempt to become conscious of *how* they are bound together as parts of this whole. The student feels that 'in a general way,' as we say, the facts of the history or geography lesson are related thus and so; but 'in a general way' here stands only for 'in a vague way,' somehow or other, with no clear recognition of just how.

The pupil may be encouraged to form, on the basis of the particular facts, a general notion, a conception of how they

stand related, but no pains be taken to make the student follow up the notion, to elaborate it and see just what its bearings are upon the case in hand and upon similar cases. The inductive inference, the guess, is formed by the student; if it happens to be correct, it is at once accepted by the teacher; or if it is false, it is rejected. If any amplification of the idea occurs, it is quite likely carried through by the teacher, who thereby assumes the responsibility for its intellectual development. But a complete, an integral, act of thought requires that the person making the suggestion (the guess) be responsible also for reasoning out its bearings upon the problem in hand, for developing the suggestion enough at least to indicate the ways in which it applies to and accounts for the specific data of the case. Too often when a recitation does not consist in simply testing the ability of the student to display some form of technical skill or to repeat facts and principles accepted on authority, the teacher goes to the opposite extreme; and after calling out the spontaneous reflections of the pupils, their guesses or ideas about the matter, merely accepts or rejects them, assuming himself the responsibility for their elaboration. In this way, the function of suggestion and of interpretation is excited, but it is not directed and trained. Suggestion is stimulated but is not carried over into the *reasoning* phase necessary to complete it.

In other subjects and topics, the reasoning phase is isolated, and is treated as if it were complete in itself. This false isolation may show itself in either (and both) of two points; namely, at the beginning or at the end of the resort to general intellectual procedure.

Isolation of Deduction by Commencing with It

Beginning with definitions, rules, general principles, classifications, and the like, is a common form of the first error.

This method has been such a uniform object of attack on the part of all educational reformers that it is not necessary to dwell upon it further than to note that the mistake is, logically, due to the attempt to introduce deductive considerations without first making acquaintance with the particular facts that create a need for definition and generalization. Unfortunately, the reformer sometimes carries his objection too far or, rather, locates it in the wrong place. He is led into a tirade against *all* definition, all systematization, all use of general principles, instead of confining himself to pointing out their futility and their deadness when not properly motivated by familiarity with concrete experiences. Moreover, a flat statement of a general principle may properly come at the beginning, provided it is used to challenge attention and not to close inquiry.

Isolation of Conceptions from Direction of New Observations

The isolation of general ideas is found at the other end wherever there is failure to clinch and test the results of the general reasoning processes by application to new concrete cases. The final point of the rational devices lies in their use in assimilating and comprehending individual cases. No one understands a general principle fully — no matter how adequately he can demonstrate it, to say nothing of repeating it — till he can employ it in the mastery of new situations, which, if they *are* new, differ in manifestation from the cases used in reaching the generalization. Too often the student and teacher are contented with a series of somewhat perfunctory examples and illustrations, and the student is not forced to carry the principle that he has formulated over into further cases of his own experience. In so far, the principle is inert and dead; it does not move into new facts or ideas.

Failure to Provide for Experimentation

It is only a variation upon this same theme to say that every complete act of reflective inquiry makes provision for experimentation — for testing suggested and accepted principles by employing them for the active construction of new cases, in which new qualities emerge. Only slowly do our schools accommodate themselves to the general advance of scientific method. From the scientific side, it is demonstrated that effective and integral thinking is possible only where the experimental method in some form is used. Some recognition of this principle is evinced in higher institutions of learning, colleges, and high schools. But in elementary education, it is still assumed, for the most part, that the pupil's natural range of observations, supplemented by what he accepts on hearsay, is adequate for intellectual growth. Of course it is not necessary that laboratories shall be introduced under that name, much less that elaborate apparatus be secured; but the entire scientific history of humanity demonstrates that the conditions for complete mental activity do not exist unless adequate provision is made for carrying on activities that actually modify physical conditions, and that books, pictures, and even objects, that are passively observed but not manipulated do not furnish the required provision.

The counterpart error has already been touched upon. In some 'progressive' schools, continual outward activity, even though of a somewhat random and disconnected character, is treated as if it were experimentation. In truth, every genuine experiment involves a problem in which something must be found out and where overt action must be guided by an idea used as a working hypothesis so as to give action purpose and point.

Failure to Summarize Net Accomplishment

In such schools there is also a tendency to overlook the need of constant review, in the sense of looking back over what has been done and has been found out, so as to formulate the net outcome, thus getting mentally rid of débris, of all material and acts that do not sustain the outcome. Just because too explicit formulation and organization should *not* come at the beginning, it is so much the more necessary that the ongoing process of experience should be periodically arrested to make a survey of what has been going on and to secure a summary of its *net* accomplishment. Otherwise loose and disorderly habits are promoted.

CHAPTER THIRTEEN

EMPIRICAL AND SCIENTIFIC THOUGHT

I. What Is Meant by Empirical

Many of our ordinary inferences, in fact all of them that have not been regulated by scientific method, are empirical in character; that is to say, they are in effect habits of expectation based upon some regular conjunction or coincidence in the experience of the past. Whenever two things are associated together, like, say, thunder and lightning, there is a tendency on the part of the mind to expect that, when one occurs, the other will happen too. When the conjunction is frequently repeated, the tendency to expect becomes a positive belief that the things are so connected that it is safe to reason that when one happens, the other is sure, or almost sure, to accompany it.

For example, A says, "It will probably rain to-morrow." B asks, "Why do you think so?" and A replies, "Because the sky was lowering at sunset." When B asks, "What has that to do with it?" A responds, "I don't know, but it generally does rain after such a sunset." He does not know of any objective *connection* between the appearance of the sky and coming rain; he is not aware of any continuity in the facts themselves — any law or principle, as we usually say. From frequently recurring conjunctions of the two events, he has associated them so that, when he sees one, he thinks of the other. One *suggests* the other or is *associated* with it. A man may believe it will rain to-morrow

because he has consulted the barometer; but if he has no conception how the height of the mercury column (or the position of an index moved by its rise and fall) is connected with variations of atmospheric pressure, and how these in turn are connected with a tendency toward precipitation, his belief in the likelihood of rain is purely empirical. When men lived in the open and got their living by hunting, fishing, or pasturing flocks, the detection of the signs and indications of weather changes was a matter of great importance. A body of proverbs and maxims, forming an extensive section of traditionary folklore, was developed. But as long as there was no understanding *why* or *how* certain events were signs, as long as foresight and weather shrewdness rested simply upon repeated conjunction among facts, beliefs about the weather were thoroughly empirical.

Empirical Thinking Is Useful in Some Matters

In similar fashion wise men in the Orient learned to predict, with considerable accuracy, the recurrent positions of the planets, the sun, and the moon, and to foretell the time of eclipses, without understanding in any degree the laws of the movements of heavenly bodies — that is, without having a notion of the continuities existing among the facts themselves. They had learned from repeated observations that things happened in about such and such a fashion. Till a comparatively recent time, the truths of medicine were mainly in the same condition. Experience had shown that 'upon the whole,' 'as a rule,' 'generally or usually speaking,' certain results followed certain remedies, when certain symptoms were given. Most of our beliefs about human nature in individuals (psychology) and in masses (sociology) are still of a largely empirical sort. Even the science of geometry, now frequently reckoned a typical rational science, began, among the Egyptians, as an accumulation of

recorded observations about methods of approximate mensuration of land surfaces and only gradually assumed, among the Greeks, scientific form.

It Has Three Obvious Disadvantages

The *disadvantages* of purely empirical thinking are obvious. Attention may be called to three of them: (1) its tendency to lead to false beliefs, (2) its inability to cope with the novel, and (3) its tendency to engender mental inertia and dogmatism.

False Beliefs. First, while many empirical conclusions are, roughly speaking, correct; while they are exact enough to be of great help in practical life; while the presages of a weatherwise sailor or hunter may be more accurate, within a certain restricted range, than those of a scientist who relies wholly upon scientific observations and tests; while, indeed, empirical observations and records furnish the raw or crude material of scientific knowledge, yet the empirical method affords no way of discriminating between right and wrong conclusions. Hence it is responsible for a multitude of *false* beliefs. The technical designation for one of the commonest fallacies is *post hoc, ergo propter hoc;* the belief that because one thing comes *after* another, it comes *because* of the other. Now this weakness in method is the animating principle of empirical conclusions, even when they are correct — the correctness being almost as much a matter of luck as of method. That potatoes should be planted only during the crescent moon, that near the sea people are born at high tide and die at low tide, that a comet is an omen of danger, that bad luck follows the cracking of a mirror, that a patent medicine cures a disease — these and a thousand like notions are asseverated on the basis of empirical coincidence and conjunction.

The more numerous the experienced instances and the

closer the watch kept upon them, the greater is the trustworthiness of constant conjunction as evidence of connection among the things themselves. Many of our most important beliefs still have only this sort of warrant. No one can yet tell, with certainty, the necessary cause of old age or of death, which are empirically the most certain of all expectations.

Confronting the Novel. Second, even the most reliable beliefs of this type fail when they confront the *novel.* Since they rest upon past uniformities, they are useless when further experience departs in any considerable measure from ancient incident and wonted precedent. Empirical inference follows the grooves and ruts that custom wears and has no track to follow when the groove disappears. So important is this aspect of the matter that Clifford found the difference between ordinary skill and scientific thought right here. "Skill enables a man to deal with the same circumstances that he has met before, scientific thought enables him to deal with different circumstances that he has never met before." And he goes so far as to define scientific thinking as "the application of old experience to new circumstances."

Mental Inertia and Dogmatism. Third, we have not yet made the acquaintance of the most harmful feature of the empirical method. Mental inertia, laziness, unjustifiable conservatism, are its probable accompaniments. Its general effect upon mental attitude is more serious than even the specific wrong conclusions in which it has landed. Wherever the chief dependence in forming inferences is upon the conjunctions observed in past experience, failures to agree with the usual order are slurred over, cases of successful confirmation are exaggerated. Since the mind naturally demands some principle of continuity, some connecting link between separate facts and causes, forces are arbitrarily invented for that purpose. Fantastic and mythological explanations are

resorted to in order to supply missing links. The pump brings water because nature abhors a vacuum; opium makes men sleep because it has a dormitive potency; we recollect a past event because we have a faculty of memory. In the history of the progress of human knowledge, out-and-out myths accompany the first stage of empiricism, while hidden 'essences' and occult 'forces' mark its second stage. By their very nature these 'causes' escape observation, so that their explanatory value can be neither confirmed nor refuted by further observation or experience. Hence belief in them becomes purely traditionary. They give rise to doctrines that, inculcated and handed down, become dogmas; subsequent inquiry and reflection are actually stifled.[1]

Certain men or classes of men come to be the accepted guardians and transmitters — instructors — of established doctrines. To question the beliefs is to question their authority; to accept the beliefs is evidence of loyalty to the powers that be, a proof of good citizenship. Passivity, docility, acquiescence, come to be primal intellectual virtues. Facts and events presenting novelty and variety are slighted or are sheared down till they fit into the Procrustean bed of habitual belief. Inquiry and doubt are silenced by citation of ancient laws or a multitude of miscellaneous and unsifted cases. This attitude of mind generates dislike of change, and the resulting aversion to novelty is fatal to progress. What will not fit into the established canons is outlawed; men who make new discoveries are objects of suspicion and even of persecution. Beliefs that perhaps originally were the products of fairly extensive and careful observation are stereotyped into fixed traditions and semi-sacred dogmas, accepted simply upon authority, and are mixed with fantastic conceptions that happen to have won the acceptance of authorities.

[1] See page 27.

II. Scientific Method

Scientific Method Employs Analysis

In contrast with the empirical method stands the scientific. Scientific method replaces the repeated conjunction or coincidence of separate facts by discovery of a single comprehensive fact, effecting this replacement by *breaking up the coarse or gross facts of observation into a number of minuter processes not directly accessible to perception.*

If a layman were asked why water rises from the cistern when an ordinary pump is worked, he would doubtless answer, "By suction." Suction is regarded as a force like heat or pressure. If such a person is confronted by the fact that water rises with a suction pump only about thirty-three feet, he easily disposes of the difficulty on the ground that all forces vary in their intensities and finally reach a limit at which they cease to operate. The variation with elevation above the sea level of the height to which water can be pumped is either unnoticed, or, if noted, is dismissed as one of the curious anomalies in which nature abounds.

Now the scientist advances by assuming that what seems to observation to be a single total fact is in truth complex. He attempts, therefore, to break up the single fact of water-rising-in-the-pipe into a number of lesser facts, in short, into data.[2] His method of proceeding is by *varying conditions one by one* so far as possible, and noting just what happens when each given condition is eliminated. In this way a fact too coarse and too extensive to be explained as a whole is resolved into a set of minor facts. Each minor fact is understood because it states a connection of cause and effect.

[2] See page 104.

Two Methods of Varying Conditions

There are two methods of varying conditions.[3] The first is an extension of the empirical method of observation. It consists in comparing very carefully the results of a great number of observations that have occurred accidentally under *different* conditions. The difference in the rise of the water at different heights above the sea level and its total cessation when the distance to be lifted is, even at sea level, more than thirty-three feet, are emphasized, instead of being slurred over. The purpose is to find out what *special conditions* are present when the effect occurs and are absent when it fails to occur. These special conditions are then substituted for the gross fact. Some of these more definite and exact data will give the key to understanding the event.

The method of analysis by comparing cases is, however, badly handicapped; it can do nothing until a certain number of diversified cases happen to present themselves. And even when such cases are at hand, it will be questionable whether they vary in just these respects in which it is important that they should vary in order to throw light upon the question at issue. The method is passive and dependent upon external accidents. Hence the superiority of the active, or experimental, method. Even a small number of observations may suggest an explanation — a hypothesis, or theory. Working upon this suggestion, the scientist then *intentionally* varies conditions and notes what happens. If the empirical observations have suggested to him the possibility of a connection between air pressure on the water and the rising of the water in the tube where air pressure is absent, he deliberately empties the air out of the vessel in which the water

[3] The next two paragraphs repeat, for purposes of the present discussion, what we have already noted in a different context. See page 176.

is contained and notes that 'suction' no longer works, or he intentionally increases atmospheric pressure on the water and notes the result. He institutes experiments to calculate the weight of air at the sea level and at various levels above and compares the results of reasoning based upon the pressure of air of these various weights upon a certain volume of water with the results actually obtained by observation. *Observations formed by variation of conditions on the basis of some idea or theory constitute experiment.* Experiment is the chief resource in scientific reasoning because it facilitates the picking out of significant elements in a gross, vague whole.

Experiment Involves both Analysis and Synthesis

Experimental thinking, or scientific reasoning, is thus a conjoint process of *analysis and synthesis,* or, in less technical language, of discrimination and identification. The gross fact of water rising when the suction valve is worked is resolved or discriminated into a number of independent variables, some of which had never before been observed or even thought of in connection with the fact. One of these facts, the weight of the atmosphere, is then selectively seized upon as the key to the entire phenomenon. This disentangling constitutes *analysis*. But atmosphere and its pressure or weight is a fact not confined to this single instance. It is a fact familiar, or at least discoverable as operative, in a great number of other events. In fixing upon this imperceptible and minute fact as the essence or key to the elevation of water by the pump, the pump-fact has thus been assimilated to a whole group of ordinary facts from which it was previously isolated. This assimilation constitutes *synthesis*. Moreover, the fact of atmospheric pressure is itself a case of one of the commonest of all facts — weight, or gravitational force. Conclusions that apply to the common fact of

weight are thus transferable to the consideration and interpretation of the *relatively* rare and exceptional case of the suction of water. The suction pump is seen to be a case of the same kind or sort as the siphon, the barometer, the rising of the balloon, and a multitude of other things with which at first sight it has no connection at all. This is another instance of the synthetic, or integrative, function of thinking.

If we revert to the advantages of scientific over empirical thinking, we find that we now have the clue to them.

Lessened Liability to Error. The increased security, the added factor of certainty or proof, is due to the substitution of the *detailed and specific fact* of atmospheric pressure for the gross and total and relatively miscellaneous fact of suction. The latter is complex, and its complexity is due to many unknown and unspecified factors; hence, any statement about it is more or less random and likely to be defeated by any unforeseen variation of circumstances. *Comparatively,* at least, the minute and detailed fact of air pressure is a measurable and definite fact — one that can be picked out and managed with assurance.

Ability to Manage the New. As analysis accounts for the added certainty, so synthesis accounts for ability to cope with the novel and variable. Weight is a much commoner fact than atmospheric weight, and this in turn is a much commoner fact than the workings of the suction pump. To be able to substitute the common and frequent fact for that which is relatively rare and peculiar is to reduce the seemingly novel and exceptional to cases of a general and familiar principle and thus to bring them under control for interpretation and prediction.

As Professor James says:

> Think of heat as motion and whatever is true of motion will be true of heat; but we have a hundred experiences of motion for every one of heat. Think of rays passing through

this lens as cases of bending toward the perpendicular, and you substitute for the comparatively unfamiliar lens the very familiar notion of a particular change in direction of a line, of which notion every day brings us countless examples.[4]

Interest in the Future. The change of attitude from conservative reliance upon the past, upon routine and custom, to faith in progress through the intelligent regulation of existing conditions is, of course, the reflex of the scientific method of experimentation. The empirical method inevitably magnifies the influences of the past; the experimental method throws into relief the possibilities of the future. The empirical method says, "*Wait* till there is a sufficient number of cases;" the experimental method says, "*Produce* the cases." The former depends upon nature's accidentally happening to present us with certain conjunctions of circumstances; the latter deliberately and intentionally endeavors to bring about the conjunction. By this method the notion of progress secures scientific warrant.

Scientific Thinking Is Freed from Considerations of the Immediate and the Forceful

Ordinary experience is controlled largely by the direct strength and intensity of various occurrences. What is bright, sudden, loud, secures notice and is given a conspicuous rating. What is dim, feeble, and continuous gets ignored, or is regarded as of slight importance. Customary experience tends to the control of thinking by considerations of *direct and immediate strength* rather than by those of importance in the long run. Animals without the power of forecast and planning must, upon the whole, respond to the stimuli that are most urgent at the moment or cease to exist. These stimuli lose nothing of their direct urgency and

[4] *Psychology*, vol. II, p. 342.

clamorous insistency when the thinking power develops; and yet thinking demands the subordination of the immediate stimulus to the remote and distant. The feeble and the minute may be of much greater importance than the glaring and the big. The latter may be signs of a force that is already exhausting itself; the former may indicate the beginnings of a process in which the whole fortune of the individual is involved. The prime necessity for scientific thought is that the thinker be freed from the tyranny of sense stimuli and habit, and this emancipation is also the necessary condition of progress.

Consider the following quotation:

> When it first occurred to a reflecting mind that moving water had a property identical with human or brute force; namely, the property of setting other masses in motion, overcoming inertia and resistance, — when the sight of the stream suggested through this point of likeness the power of the animal, — a new addition was made to the class of prime movers; and when circumstances permitted, this power could become a substitute for the others. It may seem to the modern understanding, familiar with water wheels and drifting rafts, that the similarity here was an extremely obvious one. But if we put ourselves back into an early state of mind, when running water affected the mind *by its brilliancy, its roar and irregular devastation,* we may easily suppose that to identify this with animal muscular energy was by no means an obvious effort.[5]

The Value of Abstraction

If we add to these obvious sensory features the various social customs and expectations that fix the attitude of the individual, the evil of the subjection of free and fertile suggestion to empirical considerations — that is, to the *past*

[5] Bain, *The Senses and Intellect,* third American ed., 1879, p. 492 (italics not in original).

and to more or less uncontrolled experience — becomes evident.

Abstraction is an indispensable element in even ordinary thinking. It is found in all analysis, in all observation that detaches a quality from a vague blur in which it has been absorbed so as to give it distinctness. But scientific abstraction lays hold upon *relations* that could not in any case be perceived by sense. Its character is well brought out in the quotation just made from Bain. Some man got away from the almost overpowering conspicuous traits of running water to grasp a relation, that of carrying power.

A notion of abstraction is sometimes advanced that neglects this property and makes it intellectually insignificant. It is supposed to be simply the power of attending to some quality that an object is already known to possess to the exclusion of all other traits and features. But while this act is, under some circumstances, of practical value, the logical value of abstraction consists in seizing upon some quality or relation not previously grasped at all, making it stand out. It was an act of abstraction when the wing of a bird was seen to be identical, morphologically, with the forearm or foreleg, of other mammals; when the pod of peas and beans was seen to be a modified form of leaf and stem. Abstracting gets the mind emancipated from conspicuous familiar traits that hold it fixed by their very familiarity. Thereby it acquires ability to dig underneath the already known to some unfamiliar property or relation that is intellectually much more significant because it makes possible a more analytic and more extensive inference.

The Meaning of 'Experience'

The term *experience* may thus be interpreted with reference either to the *empirical* or to the *experimental* attitude of mind. Experience is not a rigid and closed thing; it is

vital, and hence growing. When dominated by the past, by custom and routine, it is often opposed to the reasonable, the thoughtful. But experience also includes the reflection that sets us free from the limiting influence of sense, appetite, and tradition. Experience may welcome and assimilate all that the most exact and penetrating thought discovers. Indeed, the business of education might be defined as an emancipation and enlargement of experience. Education takes the individual while he is relatively plastic, before he has become so indurated by isolated experiences as to be rendered hopelessly empirical in his habit of mind. The attitude of childhood is naïve, wondering, experimental; the world of man and nature is new. Right methods of education preserve and perfect this attitude, and thereby short-circuit for the individual the slow progress of the race, eliminating the waste that comes from inert routine and lazy dependence on the past. Abstract thought is imagination seeing familiar objects in a new light and thus opening new vistas in experience. Experiment follows the road thus open and tests its permanent value.

PART THREE

THE TRAINING OF THOUGHT

CHAPTER FOURTEEN

ACTIVITY AND THE TRAINING OF THOUGHT

In this chapter we shall gather together and amplify considerations that have already been advanced, in various passages of the preceding pages, concerning the relation of *action to thought*. We shall follow, though not with exactness, the order of development in the unfolding of a human being.

I. The Early Stage of Activity

"What Is the Baby Thinking About?"

The sight of a baby often calls out the question: "What do you suppose he is thinking about?" By the nature of the case, the question is unanswerable in detail; but, also by the nature of the case, we may be sure about a baby's chief interest. His primary problem is mastery of his body as a tool of securing comfortable and effective adjustments to his surroundings, physical and social. The child has to learn to do almost everything: to see, to hear, to reach, to handle, to balance the body, to creep, to walk, and so on. Even if it be true that human beings have even more instinctive reactions than lower animals, it is also true that instinctive tendencies are much less perfect in men, and that most of them are of little use till they are intelligently combined and directed. A little chick just out of the shell will after a few trials peck at and grasp grains of food with its beak as well as at any later time. This involves a complicated coördina-

tion of the eye and the head. An infant does not even begin to reach definitely for things that the eye sees till he is several months old, and even then several weeks' practice is required before he learns the adjustment so as neither to overreach nor to underreach. It may not be literally true that the child will grasp for the moon, but it is true that he needs much practice before he can tell whether an object is within reach or not. The arm is thrust out instinctively in response to a stimulus from the eye, and this tendency is the origin of the ability to reach and grasp exactly and quickly; but nevertheless final mastery requires observing and selecting the successful movements and arranging them in view of an end. *These operations of conscious selection and arrangement constitute thinking,* though of a rudimentary type.

Mastery of the Body Is an Intellectual Problem

Since mastery of the bodily organs is necessary for all later developments, such problems are both interesting and important, and solving them supplies a very genuine training of thinking power. The joy the child shows in learning to use his limbs, to translate what he sees into what he handles, to connect sounds with sights, sights with taste and touch, and the rapidity with which intelligence grows in the first year and a half of life (the time during which the more fundamental problems of the use of the organism are mastered) are sufficient evidence that the development of physical control is not a physical, but an intellectual, achievement.

Social Adjustments Soon Become Important

Although in the early months the child is mainly occupied in learning to use his body to accommodate himself to physical conditions in a comfortable way and to use things skillfully and effectively, yet social adjustments are very

important. In connection with parents, nurse, brother, and sister, the child learns the signs of satisfaction of hunger, of removal of discomfort, of the approach of agreeable light, color, sound, and so on. His contact with physical things is regulated by persons, and he soon distinguishes persons as the most important and interesting of all the objects with which he has to do.

Speech, the accurate adaptation of sounds heard to the movements of tongue and lips, is, however, the great instrument of social adaptation; and with the development of speech (usually in the second year) adaptation of the baby's activities to and with those of other persons gives the keynote of mental life. His range of possible activities is indefinitely widened as he watches what other persons do, and as he tries to understand and to do what they encourage him to attempt. The outline pattern of mental life is thus set in the first four or five years. Years, centuries, generations of invention and planning, may have gone to the development of the performances and occupations of the adults surrounding the child. Yet for him their activities are direct stimuli; they are part of his natural environment; they are carried on in physical terms that appeal to his eye, ear, and touch. He cannot, of course, appropriate their meaning directly through his senses; but they furnish stimuli to which he responds, so that his attention is focussed upon a higher order of materials and of problems. Were it not for this process by which the achievements of one generation form the stimuli that direct the activities of the next, the story of civilization would be writ in water, and each generation would have laboriously to make for itself, if it could, its way out of savagery. In learning to understand and make words, children learn a great deal more than the words themselves. They gain a habit that opens a new world to them.

The Rôle of Imitation

Imitation is one, though only one,[1] of the means by which the activities of adults supply stimuli that are so interesting, so varied, so complex, and so novel as to occasion a rapid progress of thought. Mere imitation, however, would not give rise to thinking; if we could learn like parrots by simply copying the outward acts of others, we should never have to think; nor should we know, after we had mastered the copied act, what was the meaning of the thing we had done. Educators (and psychologists) have often assumed that acts that reproduce the behavior of others are acquired merely by imitation. But a child rarely learns by conscious imitation, and to say that his imitation is unconscious is to say that it is not, from his standpoint, imitation at all. The word, the gesture, the act, the occupation of another, falls in line with *some impulse already active* and suggests some satisfactory mode of expression, some end in which it may find fulfillment. Having this end of his own, the child then notes other persons, as he notes natural events, to get further suggestions as to means of its realization. He selects some of the means he observes, tries them on, finds them successful or unsuccessful, is confirmed or weakened in his belief in their value, and so continues selecting, arranging, adapting, testing, till he can accomplish what he wishes. The onlooker may then observe the resemblance of this act to some act of an adult and conclude that it was acquired by imitation, while as a matter of fact it was acquired by attention, observation, selection, experimentation, and confirmation by results. Only because this method is employed is there intellectual discipline and an educative result. The presence of adult activities plays an enormous rôle in the intellectual growth of the child because they add to the natu-

[1] See page 58.

ral stimuli of the world new stimuli that are more exactly adapted to the needs of a human being, that are richer, better organized, more complex in range, permitting more flexible adaptations, and calling out novel reactions. But in utilizing these stimuli, the child follows the same methods that he uses when he is forced to think in order to master his body.

II. Play, Work, and Allied Forms of Activity

The Significance of Play and of Playfulness

When things become signs, when they gain a representative capacity as standing for other things, play is transformed from mere physical exuberance into an activity involving a mental factor. A little girl who had broken her doll was seen to perform with the leg of the doll all the operations of washing, putting to bed, and fondling, that she had been accustomed to perform with the entire doll. The part stood for the whole; she reacted, not to the stimulus sensibly present, but to the meaning suggested by the sense object. So children use a stone for a table, leaves for plates, acorns for cups. So they use their dolls, their trains, their blocks, their other toys. In manipulating them, they are living not with the physical things, but in the large world of meanings, natural and social, evoked by these things. So when children play horse, play store, play house or making calls, they are subordinating the physically present to the ideally signified. In this way, a world of meanings, a store of concepts (so fundamental in all intellectual achievement), is defined and built up.

Moreover, not only do meanings thus become familiar acquaintances, but they are organized, arranged in groups, made to cohere in connected ways. A play and a story blend

insensibly into each other. The most fanciful plays of children rarely lose all touch with the mutual fitness and pertinency of various meanings to one another; the 'freest' plays observe some principles of coherence and unification. They have a beginning, middle, and end. In games, rules of order run through various minor acts and bind them into a connected whole. The rhythm, the competition, and the coöperation involved in most plays and games also introduce organization. There is, then, nothing mysterious or mystical in the discovery made by Plato and remade by Froebel that play is the chief, almost the only, mode of education for the child in the years of later infancy.

Playfulness is a more important consideration than play. The former is an attitude of mind; the latter is a passing outward manifestation of this attitude. When things are treated simply as vehicles of suggestion, what is suggested overrides the thing. Hence the playful attitude is one of freedom. The person is not bound to the physical traits of things, nor does he care whether a thing really 'means' what he takes it to represent. When the child plays horse with a broom and cars with chairs, the fact that the broom does not really represent a horse or a chair a locomotive is of no account. In order, then, that playfulness may not terminate in arbitrary fancifulness and in building up an imaginary world alongside the world of actual things, it is necessary that the play attitude should gradually pass into a work attitude.

The Significance of Work

What is work — work not as mere external performance, but as attitude of mind? In the natural course of growth, children come to find irresponsible, make-believe plays inadequate. A fiction is too easy a way out to afford contentment, not stimulus enough to call forth satisfactory mental

response. When this point is reached, the ideas that things suggest are applied to the things with some regard to fitness. A small cart, resembling a 'real' cart, with 'real' wheels, tongue, and body, meets the mental demand better than merely making believe that anything that comes to hand is a cart. Occasionally to take part in setting a 'real' table with 'real' dishes brings more reward than forever to make believe a flat stone is a table and that leaves are dishes. The interest may still center in the meanings; things may be of importance only as furthering a certain meaning. So far the attitude is one of play. But meaning becomes of such a character that it must find embodiment, or at least expression, in actual things.

The dictionary does not permit us to call such activities work. Nevertheless, they represent a passage of play into work. For work (as a mental attitude, not as mere external performance) *means interest in the adequate embodiment of a meaning* (a suggestion, purpose, aim) *in objective form through the use of appropriate materials and appliances.* Such an attitude takes advantage of the meanings aroused and built up in free play, but *controls their development by seeing to it that they are applied to things in ways consistent with the observable structure of things themselves.*

The word 'work' is not very satisfactory. For it is often used to denote routine activity that accomplishes useful results with but a minimum of thoughtful selection of means, deliberate adjustment to produce desired consequences. We view work from the outside when we think of it as simply doing things that need to be done. But it may also be looked at from the inside; it must be so looked at when we are thinking of it in relation to education. Then work signifies activity directed by ends that thought sets before the person as something to be accomplished; it signifies ingenuity and inventiveness in selecting proper means and

making plans, and thus, finally, signifies that expectations and ideas are tested by actual results.

A child, like an adult, may make or do something following the dictation of others, working mechanically from oral or printed instructions, or stereotyped blueprints. There is then next to no thought; his activity is not truly reflective. But as we have already noted, the means-consequence relation is the heart of all meaning. 'Work,' in the sense of *intelligent action*, is therefore highly educative, because it continually builds up meanings while at the same time it tests them by application to actual conditions. It is necessary, however, that the adult do not judge the value of such an activity on the part of the young by his familiar adult standards about the value of the *product;* if he does, the activity will usually seem to him to amount to little. He must judge from the standpoint of the planning, invention, ingenuity, observation, exercised by the young, remembering always that what is an old story to him may arouse emotion and thought in the child.

The True Distinction between Play and Work

The point of the distinction between play and work may be cleared up by comparing it with a more usual way of stating the difference. In play activity, it is said, the interest is in the activity for its own sake; in work, it is in the product or result in which the activity terminates. Hence the former is purely free, while the latter is tied down by the end to be achieved. When the difference is stated in this sharp fashion, there is almost always introduced a false, unnatural separation between process and product, between activity and its achieved outcome. The true distinction is not between an interest in activity for its own sake and interest in the external result of that activity, but between an interest in an activity just as it flows on from moment to

moment, and an interest in an activity as tending to a culmination, to an outcome, and therefore possessing a thread of continuity binding together its successive stages. Both may equally exemplify interest in an activity "for its own sake"; but in the one case the activity in which the interest resides is more or less casual, following the accident of circumstance and whim, or of dictation; in the other, the activity is enriched by the sense that it leads somewhere, that it amounts to something.

Were it not that the false theory of the relation of the play and the work attitudes has been connected with unfortunate modes of school practice, insistence upon a truer view might seem an unnecessary refinement. But the sharp break that so often prevails between the kindergarten and the grades is evidence that the theoretical distinction has practical implications. Under the title of 'play' the former is rendered unduly symbolic, fanciful, sentimental, and arbitrary; while under the antithetical caption of 'work' the latter contains many *tasks externally assigned*. The former has no end; the latter an end so remote that only the educator, not the child, is aware that it is an end.

There comes a time when children must extend and make more exact their acquaintance with existing things, must conceive ends and consequences with sufficient definiteness to guide their actions by them, and must acquire some technical skill in selecting and arranging means to realize these ends. Unless these factors are gradually introduced in the earlier play period, they must later be introduced abruptly and arbitrarily, to the manifest disadvantage of both the earlier and the later stages.

Correlative False Notions of Imagination and Utility

The sharp opposition of play and work is usually associated with false notions of utility and imagination. Ac-

tivity that is directed upon matters of home and neighborhood interest is depreciated as merely utilitarian. To let the child wash dishes, set the table, engage in cooking, cut and sew dolls' clothes, make boxes that will hold 'real things,' and construct his own playthings by using hammer and nails, excludes (so it is said) the æsthetic and appreciative factor, eliminates imagination, and subjects the child's development to material and practical concerns; while (so it is said) to reproduce symbolically the domestic relationships of birds and other animals, of human father and mother and child, of workman and tradesman, of knight, soldier, and magistrate, secures a liberal exercise of mind that is of great moral as well as intellectual value. It has even been stated that it is over-physical and utilitarian if a child plants seeds and takes care of growing plants in the kindergarten; whereas if he reproduces dramatically the operations of planting, cultivating, reaping, and so on, with no physical materials or with symbolic representatives, he educates imagination and his spiritual appreciation. Toy dolls, trains of cars, boats, and engines are rigidly excluded, but cubes, balls, and other symbols for representing his social activities are recommended. The more unfitted the physical object for its imagined purpose, such as a cube for a boat, the greater is the supposed appeal to the imagination.

There are several fallacies in this way of thinking.

First, the healthy imagination deals not with the unreal, but with the mental realization of what is suggested. Its exercise is not a flight into the purely fanciful and ideal, but a method of expanding and filling in what is real. To the child the homely activities going on about him are not utilitarian devices for accomplishing physical ends; they exemplify a wonderful world, the depths of which he has not sounded, a world full of the mystery and promise that attend all the doings of the grown-ups whom he admires.

However prosaic this world may be to the adults who find its duties routine affairs, to the child it is fraught with social meaning. To engage in it is to exercise the imagination in constructing an experience of wider value than any the child has yet mastered.

Second, educators sometimes think children are reacting to a great moral or spiritual truth when the children's reactions are largely physical and sensational. Children have great powers of dramatic simulation, and their physical bearing may seem (to adults prepossessed with a philosophic theory) to indicate they have been impressed with some lesson of chivalry, devotion, or nobility when the children, themselves, are occupied only with transitory physical excitations. To symbolize great truths far beyond the child's range of actual experience is an impossibility, and to attempt it is to invite love of momentary stimulation.

Third, just as the opponents of play in education always conceive of play as mere amusement, so the opponents of direct and useful activities confuse occupation with labor. The adult is acquainted with responsible labor upon which serious financial results depend. Consequently he seeks relief, relaxation, amusement. Unless children have prematurely worked for hire, unless they have come under the blight of child labor, no such division exists for them. Whatever appeals to them at all appeals directly on its own account. There is no contrast between doing things for utility and for fun. Their life is more united and more wholesome. To suppose that activities customarily performed by adults only under the pressure of utility may not be done perfectly freely and joyously by children indicates a lack of imagination. Not the thing done, but the quality of mind that goes into the doing, settles what is utilitarian and what is unconstrained and creative.

III. Constructive Occupations

The Sciences Grew out of Occupations

The history of culture shows that mankind's scientific knowledge and technical abilities have developed, especially in all their earlier stages, out of the fundamental problems of life. Anatomy and physiology grew out of the practical needs of keeping healthy and active; geometry and mechanics out of demands for measuring land, for building, and for making labor-saving machines; astronomy has been closely connected with navigation, keeping record of the passage of time; botany grew out of the requirements of medicine and of agronomy; chemistry has been associated with dyeing, metallurgy, and other industrial pursuits. In turn, modern industry is almost wholly a matter of applied science; year by year the domain of routine and crude empiricism is narrowed by the translation of scientific discovery into industrial invention. The trolley, the telephone, the electric light, the steam engine, with all their revolutionary consequences for social intercourse and control, are the fruits of science.

School Occupations Offer Intellectual Possibilities

These facts are full of educational significance. Most children are preëminently active in their tendencies. The schools have also taken on — largely from utilitarian, rather than from strictly educative, reasons — a large number of active pursuits commonly grouped under the head of manual training, including also school gardens, excursions, and various graphic arts. Perhaps the most pressing problem of education at the present moment is to organize and relate these subjects so that they will become instruments for forming alert, persistent, and fruitful *intellectual* habits. That they

take hold of the more primary and native equipment of children (appealing to their desire to do) is generally recognized; that they afford great opportunity for training in self-reliant and efficient social service is gaining acknowledgment. But they may also be used for presenting *typical problems to be solved by personal reflection and experimentation and by acquiring definite bodies of knowledge leading later to more specialized scientific knowledge.* There is indeed no magic by which mere physical activity or deft manipulation will secure intellectual results.[2] Manual subjects may be taught by routine, by dictation, or by convention as readily as bookish subjects. But intelligent consecutive work in gardening, cooking, or weaving, or in elementary wood and iron, may be so planned that it will inevitably result not only in students' amassing information of practical and scientific importance in botany, zoölogy, chemistry, physics, and other sciences, but also (what is more significant) in their becoming versed in methods of experimental inquiry and proof.

That the elementary curriculum is overloaded is a common complaint. The only alternative to a reactionary return to the educational traditions of the past lies in working out the intellectual possibilities resident in various arts, crafts, and occupations, and reorganizing the curriculum accordingly. Here, more than elsewhere, are found the means by which the blind and routine experience of the race may be transformed into illuminated and emancipated experiment.

Conditions to Be Met to Render 'Projects' Educative

Constructive occupations have in recent years found their way increasingly into the schoolroom. They are usually known as 'projects.' In order that they may be truly

[2] See page 52.

educative, there are certain conditions that should be fulfilled.

The first condition, that of interest, is usually met. Unless the activity lays hold on the emotions and desires, unless it offers an outlet for energy that means something to the individual himself, his *mind* will turn in aversion from it, even though externally he keeps at it. But interest is not enough. Given interest, the important matter is *what kind of object and action* enlists it. Is it something transitory or is it enduring? Is the interest mainly one of excitement or is thought involved?

Hence the second condition to be met is that the activity be worth while intrinsically. This statement does not signify, as we have just seen in another connection, that its outcome be something externally useful from the adult point of view. But it does mean that merely trivial activities, those that are of no consequence beyond the immediate pleasure that engaging in them affords, should be excluded. It is not difficult to find projects that are enjoyable while at the same time they stand for something valuable in life itself.

The third condition (really only an amplification of the point just made) is that the project in the course of its development present problems that awaken new curiosity and create a demand for information. There is nothing educative in an activity, however agreeable it may be, that does not lead the mind out into new fields. The new field cannot be entered unless the mind is led to ask questions that it had not thought of before and unless the presence of these questions creates a thirst for additional information to be obtained by observation, by reading, by consulting persons expert in that particular field.

Finally, as a fourth condition, the project must involve a considerable time span for its adequate execution. The plan and the object to be gained must be capable of development,

one thing leading on naturally to another. Unless it does so, new fields cannot be entered. It is the province of the adult to look ahead and see whether one stage of achievement will suggest something else to be looked into and done. An occupation has continuity. It is not a succession of unrelated acts, but is a consecutively ordered activity in which one step prepares the need for the next one and that one adds to, and carries further in a cumulative way, what has already been done.

CHAPTER FIFTEEN

FROM THE CONCRETE TO THE ABSTRACT

I. What Is the Concrete?

The maxim enjoined upon teachers, "proceed from the concrete to the abstract," is familiar rather than wholly intelligible. Few who read and hear it gain a clear conception of the starting point, the concrete; of the nature of the goal, the abstract; and of the exact nature of the path to be traversed in going from one to the other. At times the injunction is positively misunderstood, being taken to mean that education should advance from things to thought — as if any dealing with things in which thinking is not involved could possibly be educative. So understood, the maxim encourages mechanical routine or sensuous excitation at one end of the educational scale — the lower — and academic and unapplied learning at the upper end.

Actually, all dealing with things, even the child's, is immersed in inference; things are clothed with the suggestions they arouse. They are significant as challenges to interpretation or as evidences to substantiate a belief. Nothing could be more unnatural than instruction in things without thought, in sense-perceptions without judgments connected with them. And if the abstract to which we are to proceed denotes thought apart from things, the goal is formal and empty, for effective thought always refers, more or less directly, to things.

Relation to Direct and Indirect Meaning

Yet the maxim has a meaning which, understood and supplemented, states the direction of logical development. What is this meaning? 'Concrete' denotes a meaning definitely marked off from other meanings so that it is readily apprehended by itself. When we hear the words, *table, chair, stove, coat,* we do not have to reflect in order to grasp what is meant.[1] The terms convey meaning so directly that no effort at translation is needed. The meaning of some terms and things, however, is grasped only by first calling to mind more familiar things and then tracing out connections between them and what we do not understand. Roughly speaking, the former kind of meaning is concrete; the latter is abstract.

Dependence on the Intellectual Status of the Individual

To one who is thoroughly at home in physics and chemistry, the notions of *atom* and *molecule* are fairly concrete. They are constantly used without involving any labor of thought in apprehending what they mean. But the layman and the beginner in science have to remind themselves of things with which they already are well acquainted, and then go through a process of slow translation. Moreover the terms *atom* and *molecule* lose their hard-won meaning only too easily if familiar things and the line of transition from them to the strange drop out of mind. The same difference is illustrated by any technical terms: *coefficient* and *exponent* in algebra, *triangle* and *square* in their geometric as distinct from their popular meanings; *capital* and *value* in political economy, and so on.

The difference as noted is purely relative to the intellectual progress of an individual; what is abstract at one pe-

[1] See page 150.

riod of growth is concrete at another; or even the contrary, as one finds that things supposed to be thoroughly familiar involve strange factors and unsolved problems. There is, nevertheless, a general line of cleavage that decides upon the whole what things fall within, and what fall without, the limits of familiar acquaintance. This line accordingly marks off the concrete and the abstract in a fairly permanent way. *The limits are fixed mainly by the demands of practical life.* Things such as sticks and stones, meat and potatoes, houses and trees, are constant features of the environment of which we have to take account in order to live. Hence their important meanings are soon learned and are indissolubly associated with objects. We are acquainted with a thing (or it is familiar to us) when we have so much to do with it that its strange and troublesome corners are rubbed off. The necessities of social intercourse convey to adults a like concreteness upon such terms as *taxes, elections, wages, the law,* and so on. Things the meaning of which I personally do not take in directly, appliances of cook, carpenter, or weaver, for example, are nevertheless unhesitatingly classed as concrete, since they are directly connected with our common social life.

Relation to Thinking as a Means and as an End

By contrast, the abstract is the *theoretical,* that not intimately associated with practical concerns. The abstract thinker (the 'man of pure science,' as he is sometimes called) deliberately abstracts from application in life; that is, he leaves practical uses out of account. This, however, is a merely negative statement. What remains when connections with use and application are excluded? *Evidently only what has to do with knowing considered as an end in itself.* Many notions in science are abstract, not only because they cannot be understood without a long apprenticeship in the

science (which is equally true of technical matters in the arts), but also because the whole content of their meaning has been framed for the sole purpose of facilitating further knowledge, inquiry, and speculation. *When thinking is used as a means to some end, good, or value beyond itself, it is concrete; when it is employed simply as a means to more thinking, it is abstract.* To a theorist an idea is adequate and self-contained just because it engages and rewards thought; to a medical practitioner, an engineer, an artist, a merchant, a politician, it is complete only when employed in the furthering of some interest in life — health, wealth, beauty, goodness, success, or what you will.

Depreciation of 'Mere Theory'

The great majority of men under ordinary circumstances find the practical exigencies of life almost, if not quite, coercive. Their main business is the proper conduct of their affairs. Whatever is of significance only as affording scope for thinking is pallid and remote — almost artificial. Hence the contempt felt by the practical and successful executive for the 'mere theorist'; hence his conviction that certain things may be all very well in theory, but that they will not do in practice; hence, in general, the depreciatory way in which he uses the terms *abstract, theoretical,* and *intellectual.*

This attitude is justified, of course, under certain conditions. But depreciation of theory does not contain the whole truth, as common or practical sense recognizes. There is such a thing, even from the common-sense standpoint, as being 'too practical,' as being so intent upon the immediately practical as not to see beyond the end of one's nose or as to cut off the limb upon which one is sitting. The question is one of limits, of degrees and adjustments, rather than

one of absolute separation. Truly practical men give their minds free play about a subject without asking too closely at every point for any advantage to be gained. Exclusive preoccupation with matters of use and application narrows the horizon and in the long run defeats itself. It does not pay to tether one's thoughts to the post of use with too short a rope. Power in action requires largeness of vision, which can be had only through the use of imagination. Men must at least have enough interest in thinking for the sake of thinking to escape the limitations of routine and custom. Interest in knowledge for the sake of knowledge, in thinking for the sake of the free play of thought, is necessary to the *emancipation* of practical life — to making it rich and progressive.

We now recur to the pedagogic maxim of going from the concrete to the abstract and call attention to three aspects of the process.

Beginning with Practical Manipulations

1. Since the *concrete* denotes thinking applied to activities for the sake of dealing with difficulties that present themselves practically, 'begin with the concrete' signifies that we should, at the outset of any new experience in learning, make much of what is already familiar, and if possible connect the new topics and principles with the pursuit of an end in some active occupation. We do not 'follow the order of nature' when we multiply mere sensations or accumulate physical objects. Instruction in number is not concrete merely because splints or beans or dots are employed. Whenever the use and bearing of number relations are clearly perceived, a number idea is concrete even if figures alone are used. Just what sort of symbol it is best to use at a given time — whether blocks, or lines, or figures — is entirely a matter of adjustment to the given case. If the physical things used in teaching number or geography or anything

else do not leave the mind illuminated with recognition of a *meaning* beyond themselves, the instruction that uses them is as abstruse as that which doles out ready-made definitions and rules, for it distracts attention from ideas to mere physical excitations.

The notion that we have only to put physical objects before the senses in order to impress ideas upon the mind amounts almost to a superstition. The introduction of object lessons and sense-training scored a distinct advance over the prior method of linguistic symbols, but this advance tended to blind educators to the fact that only a halfway step had been taken. Things and sensations develop the child, indeed, but only when he *uses* them in mastering his body and coördinating his actions. Continuous occupations involve the use of natural materials, tools, modes of energy, and do it in a way that compels thinking as to how they are related to one another and to the realization of ends. But the mere isolated presentation of things to sense remains barren and dead. A few generations ago the great obstacle in the way of reform of primary education was belief in the almost magical efficacy of the symbols of language (including number) to produce mental training; at present, belief in the efficacy of objects just as objects blocks the way. As frequently happens, the better is an enemy of the best.

Transferring Interest to Intellectual Matters

2. The interest in results, in the successful carrying on of an activity, should be gradually transferred to the *study* of objects — their properties, consequences, structures, causes, and effects. The adult when at work in his life calling is rarely free to devote time or energy — beyond the necessities of his immediate action — to the study of what he deals with.[2] The educative activities of childhood should be so

[2] See page 50.

arranged that the activity creates a demand for attention to matters that have only an indirect and an intellectual connection with the original activity. To take an instance to which reference has already been made, the direct interest in carpentering or shop work should gradually pass into an interest in geometric and mechanical problems. The interest in cooking should grow into an interest in chemical experimentation and the physiology and hygiene of bodily growth. The original casual making of pictures should pass to an interest in the technique of representation of perspective, the handling of brush, pigments, etc. This development is what the term "go" signifies in the maxim "*go* from the concrete to the abstract"; it represents the dynamic and educative phase of the process.

Developing Delight in Thinking

3. The outcome, the *abstract* to which education is to proceed, is an interest in intellectual matters for their own sake, a delight in thinking for the sake of thinking. It is an old story that acts and processes that at the outset are incidental to something else develop and maintain an absorbing value of their own. So it is with thinking and with knowledge; at first incidental to results and adjustments beyond themselves, they attract more and more attention to themselves till they become ends, not means. Children engage, unconstrainedly and continually, in reflective inspection and testing for the sake of what they are interested in doing. Habits of thinking thus generated may increase in amount till they become of importance on their own account. It is part of the business of a teacher to lead students to extricate and dwell upon the distinctively intellectual side of what they do until there develops a spontaneous interest in ideas and their relations with one another — that is, a genuine power of abstraction, of rising from engrossment in the present to the plane of ideas.

II. What Is the Abstract?

Examples of the Transition from Concrete to Abstract

The three instances cited in Chapter VI represent an ascending cycle from the concrete to the abstract. Taking thought to keep a personal engagement is obviously of the concrete kind. Endeavoring to work out the meaning of a certain part of a boat is an instance of an intermediate kind. The original reason for the existence and position of the pole is practical, so that to the designer the problem was purely concrete — the maintenance of a certain system of action. But for the passenger on the boat, the problem was theoretical, more or less speculative. It made no difference to his reaching his destination whether he worked out the meaning or not. The third case, that of the appearance and movement of the bubbles, illustrates a strictly abstract case. No overcoming of physical obstacles, no adjustment of external means to ends, is at stake. Curiosity, intellectual curiosity, is challenged by a seemingly anomalous occurrence; and thinking tries simply to account for an apparent exception in terms of recognized principles. Intellectual means are adjusted to an intellectual result.

Abstract Thinking Not the Whole End and Not Congenial to Most Persons

Abstract thinking, it should be noted, represents *an* end, not *the* end. The power of sustained thinking on matters remote from direct use is an outgrowth of thinking on practical and immediate matters, but not a substitute for it. The educational end is not the destruction of power to think practically in overcoming obstacles, utilizing resources, and achieving ends; it is not its replacement by abstract reflec-

tion. Nor is theoretical thinking a higher type of thinking than practical. A person who has at command both types of thinking is of a higher order than he who possesses only one. Methods that, in developing abstract intellectual abilities, weaken habits of practical or concrete thinking fall as much short of the educational ideal as do the methods that, in cultivating ability to plan, to invent, to arrange, to forecast, fail to secure some delight in thinking, irrespective of practical consequences.

Educators should also note the very great individual differences that exist; they should not try to force one pattern and model upon all. In many (probably the majority) the executive tendency, the habit of mind that thinks for purposes of conduct and achievement, not for the sake of knowing, remains dominant to the end. Engineers, lawyers, doctors, merchants, are much more numerous in adult life than scientists and philosophers. While education should strive to make men who, however prominent their professional interests and aims, partake of the spirit of the scholar, philosopher, and scientist, no good reason appears why education should esteem the one mental habit inherently superior to the other and deliberately try to transform the type from concrete to abstract. Have not our schools been one-sidedly devoted to the more abstract type of thinking, thus doing injustice to the majority of pupils? Has not the idea of a 'liberal' and 'humane' education tended too often in practice to the production of technical, because overspecialized, thinkers?

Education Should Aim to Secure a Working Balance

The aim of education should be to secure a balanced interaction of the two types of mental attitude, having sufficient regard to the disposition of the individual not to hamper and cripple whatever powers are naturally strong

in him. The narrowness of individuals of strong concrete bent needs to be liberalized. Every opportunity that occurs within practical activities for developing curiosity and susceptibility to intellectual problems should be seized. Violence is not done to natural disposition; rather the latter is broadened. Otherwise, the concrete becomes narrowing and deadening. As regards the smaller number of those who have a taste for abstract, purely intellectual topics, pains should be taken to multiply opportunities for the application of ideas, for translating symbolic truths into terms of everyday and social life. Every human being has both capabilities, and every individual will be more effective and happier if both powers are developed in easy and close interaction with each other. Otherwise the abstract becomes identical with the academic and pedantic.

CHAPTER SIXTEEN

LANGUAGE AND THE TRAINING OF THOUGHT

I. Language as the Tool of Thinking

Language has such a peculiarly intimate connection with thought as to require special discussion. The very word logic, coming from logos (λόγος), means indifferently both word or speech and thought or reason. Yet "words, words, words" denote intellectual barrenness, a sham of thought. Schooling has language as its chief instrument (and often as its chief subject matter) of study. Yet educational reformers have for centuries brought their severest indictments against the current use of language in the schools. The conviction that language is necessary to thinking (is even identical with it) is met by the contention that language perverts and conceals thought. There is a genuine problem here.

Views of the Relation of Thought and Language

Three typical views have been maintained regarding the relation of thought and language: first, that they are identical; second, that words are the garb, or clothing, of thought, necessary not for thought but only for conveying it; and third (the view we shall here maintain), that, while language is not thought, it is necessary for thinking as well as for communication. When it is said, however, that thinking is impossible without language, we must recall that language includes much more than oral and written speech.

Gestures, pictures, monuments, visual images, finger movements — anything deliberately and artificially employed as a *sign* is, logically, language. To say that language is necessary for thinking is to say that signs are necessary. Thought deals not with bare things, but with their *meanings*, their suggestions; and meanings, in order to be apprehended, must be embodied in sensible and particular existences. Without meaning, things are nothing but blind stimuli, brute things, or chance sources of pleasure and pain; and since meanings are not themselves tangible things, they must be anchored by attachment to some physical existence. Existences that are especially set aside to fixate and convey meanings are *symbols*. If a man moves toward another to throw him out of the room, his movement is not a sign. If, however, the man points to the door with his hand, or utters the sound *go*, his act becomes a vehicle of meaning: it is a sign, not a complete thing in itself. In the case of signs we care nothing for what they are in themselves, but everything for what they signify and represent. *Canis, Hund, chien, dog* — it makes no difference what the outward thing is, so long as the meaning is presented.

Natural objects are signs of other things and events. Clouds stand for rain; a footprint represents game or an enemy; a projecting rock serves to indicate minerals below the surface. The limitations of *natural* signs are, however, great. First, physical or direct sense excitation tends to distract attention from what is meant or indicated. Almost every one will recall pointing out to a kitten or puppy an object of food, only to have the animal devote himself to the hand pointing, not to the thing pointed at. Second, where natural signs alone exist, we are mainly at the mercy of external happenings; we have to wait until the natural event presents itself in order to be warned or advised of the possibility of some other event. Third, natural signs, not being

originally intended to be signs, are cumbrous, bulky, inconvenient, unmanageable. A symbol, on the contrary, is intended and invented, like any artificial tool and utensil, for the purpose of conveying meaning.

Aspects of Artificial Signs That Favor Their Use to Represent Meanings

It is therefore indispensable for any high development of thought that there exist intentional signs. Language supplies the requirement. Gestures, sounds, written or printed forms, are strictly physical existences, but their native value is intentionally subordinated to the value they acquire as representative of meanings. There are three aspects of artificial signs that favor their use as representatives of meanings:

First, the direct and sensible value of faint sounds and minute written or printed marks is very slight. Accordingly, attention is not distracted from their *representative* function.

Second, their production is under our direct control, so that they may be produced when needed. When we can make the word *rain,* we do not have to wait for some physical forerunner of rain to call our thoughts in that direction. We cannot make the cloud; we can make the sound, and as a token of meaning the sound serves the purpose as well as the cloud.

Third, arbitrary linguistic signs are convenient and easy to manage. They are compact, portable, and delicate. As long as we live we breathe, and modifications by the muscles of throat and mouth of the volume and quality of the air are simple, easy, and indefinitely controllable. Bodily postures and gestures of the hand and arm are also employed as signs, but they are coarse and unmanageable compared with modifications of breath to produce sounds. No wonder

that oral speech has been selected as the main stuff of intentional intellectual signs. Sounds, while subtle, refined, and easily modifiable, are transitory. This defect is met by the system of written and printed words, appealing to the eye. *Litera scripta manet.*

Bearing in mind the intimate connection of meanings and signs (or language), we may note in more detail what language does (1) for specific meanings, and (2) for the organization of meanings.

Language Selects, Preserves, and Applies Specific Meanings

In the case of specific meanings a verbal sign (*a*) selects, detaches, a meaning from what is otherwise a vague flux and blur (see p. 141); (*b*) retains, registers, stores that meaning; and (c) applies it, when needed, to the comprehension of other things. Combining these various functions in a mixture of metaphors, we may say that a linguistic sign is a fence, a label, and a vehicle — all in one.

a. The Word as a Fence. Everyone has experienced how learning an appropriate name for what was dim and vague cleared up and crystallized the whole matter. Some meaning seems almost within reach, but is elusive; it refuses to condense into definite form; the attaching of a word somehow (just how, it is almost impossible to say) puts limits around the meaning, draws it out from the void, makes it stand out as an entity on its own account. When Emerson said that he would almost rather know the true name, the poet's name, for a thing, than to know the thing itself, he presumably had this irradiating and illuminating function of language in mind. The delight that children take in demanding and learning the names of everything about them indicates that meanings are becoming concrete individuals to them, so that their commerce with things is passing from the physical to the intellectual plane. It is hardly surprising

that savages attach a magical efficacy to words. To name anything is to give it a title, to dignify and honor it by raising it from a mere physical occurrence to a meaning that is distinct and permanent. To know the names of people and things and to be able to manipulate these names is, in savage lore, to be in possession of their dignity and worth, to master them.

b. The Word as a Label. Things come and go, or we come and go, and either way things escape our notice. Our direct sensible relation to things is very limited. The suggestion of meanings by natural signs is limited to occasions of direct contact or vision. But a meaning fixed by a linguistic sign is conserved for future use. Even if the thing is not there to represent the meaning, the word may be produced so as to evoke the meaning. Since intellectual life depends on possession of a store of meanings, the importance of language as a tool of preserving meanings cannot be overstated. To be sure, the method of storage is not wholly aseptic; words often corrupt and modify the meanings they are supposed to keep intact, but liability to infection is a price paid by every living thing for the privilege of living.

c. The Word as a Vehicle. When a meaning is detached and fixed by a sign, it is possible to use that meaning in a new context and situation. This transfer and reapplication is the key to all judgment and inference. It would little profit a man to recognize that a given particular cloud was the premonitor of a given particular rainstorm if his recognition ended there, for he would then have to learn over and over again, since the next cloud and the next rain are different events. No cumulative growth of intelligence would occur. Experience might form habits of physical adaptation but it would not *teach* anything, for we should not be able to use an old experience consciously to anticipate and regulate a new experience. To be able to use the past to judge

and infer the new and unknown implies that, although the past thing has gone, its *meaning* abides in such a way as to be applicable in determining the character of the new. Speech forms are our great carriers, the easy-running vehicles by which meanings are transported from experiences that no longer concern us to those that are as yet dark and dubious.

Language Signs Are Instruments for Organizing Meanings

In emphasizing the importance of signs in relation to specific meanings, we have overlooked another aspect, equally valuable. Signs not only mark off specific or individual meanings, but they are also instruments of grouping meanings in relation to one another. Words are not only names or titles of single meanings; they also form *sentences* in which meanings are organized in relation to one another. When we say "That book is a dictionary," or "That blur of light in the heavens is Halley's comet," we express a *logical* connection — an act of classifying and defining that goes beyond the physical thing into the logical region of genera and species, things and attributes. Propositions, sentences, bear the same relation to judgments that distinct words, built up mainly by analyzing propositions in their various types, bear to meanings or conceptions; and just as words imply a sentence, so a sentence implies a larger whole of consecutive discourse into which it fits. As is often said, grammar expresses the unconscious logic of the popular mind. *The chief intellectual classifications that constitute the working capital of thought have been built up for us by our mother tongue.* Our very lack of explicit consciousness, when using language, that we are then employing the intellectual systematizations of the race shows how thoroughly accustomed we have become to its logical distinctions and groupings.

II. The Abuse of Linguistic Methods in Education

Teaching Things Alone, the Negation of Education

Taken literally, the maxim, 'Teach things, not words,' or 'Teach things before words,' would be the negation of education; it would reduce mental life to mere physical and sensible adjustments. Learning, in the proper sense, is not learning things, but the *meanings* of things, and this process involves the use of signs, or language in its generic sense. In like fashion, the warfare of some educational reformers against symbols, if pushed to extremes, involves the destruction of intellectual life, since this lives, moves, and has its being in those processes of definition, abstraction, generalization, and classification that are made possible by symbols alone. Nevertheless, these contentions of educational reformers have been needed. The liability of a thing to abuse is in proportion to the value of its right use.

The Limitations and Dangers of Symbols in Relation to Meanings

Symbols themselves, as already pointed out, are particular, physical, sensible existences, like any other things. They are symbols only by virtue of what they suggest and represent; *i.e.*, meanings.

In the first place, they stand for these meanings to any individual only when he has had *experience* of some situation to which these meanings are actually relevant. Words can detach and preserve a meaning only when the meaning has been first involved in our own direct intercourse with things. To attempt to give a meaning through a word alone without any dealings with a thing is to deprive the word of intelligible signification; against this attempt, a tendency

only too prevalent in education, reformers have protested. Moreover, there is a tendency to assume that, whenever there is a definite word or form of speech, there is also a definite idea; while, as a matter of fact, adults and children alike are capable of using even formulæ that are verbally precise with only the vaguest and most confused sense of what they mean. Genuine ignorance is more profitable because it is likely to be accompanied by humility, curiosity, and open-mindedness; whereas ability to repeat catch-phrases, cant terms, familiar propositions, gives the conceit of learning and coats the mind with a varnish waterproof to new ideas.

In the second place, although new combinations of words without the intervention of physical things may supply new ideas, there are limits to this possibility. Lazy inertness causes individuals to accept ideas that have currency about them without personal inquiry and testing. A man uses thought, perhaps, to find out what others believe, and then stops. The ideas of others as embodied in language become substitutes for one's own ideas. The use of linguistic studies and methods to halt the human mind on the level of the attainments of the past, to prevent new inquiry and discovery, to put the authority of tradition in place of the authority of natural facts and laws, to reduce the individual to a parasite living on the secondhand experience of others — these things have been the source of the reformers' protest against the preëminence assigned to language in schools.

In the third place, words that originally stood for ideas come, with repeated use, to be mere counters; they become physical things to be manipulated according to certain rules or reacted to by certain operations without consciousness of their meaning. Mr. Stout (who has called such terms "substitute signs") remarks that "algebraical and arith-

metical signs are to a great extent used as mere substitute signs. . . . It is possible to use signs of this kind whenever fixed and definite rules of operation can be derived from the nature of the things symbolized, so as to be applied in manipulating the signs, without further reference to their signification. A word is an instrument for thinking about the meaning which it expresses; a substitute sign is a means of *not* thinking about the meaning which it symbolizes." The principle applies, however, to ordinary words, as well as to algebraic signs; they also enable us to use meanings so as to get results without thinking. In many respects, signs that are means of not thinking are of great advantage; standing for the familiar, they release attention for meanings that, being novel, require conscious interpretation. Nevertheless, the premium put in the schoolroom upon attainment of technical facility, upon skill in producing external results,[1] often changes this advantage into a positive detriment. In manipulating symbols so as to recite well, to get and give correct answers, to follow prescribed formulæ of analysis, the pupil's attitude becomes mechanical, rather than thoughtful; verbal memorizing is substituted for inquiry into the meaning of things. This danger is perhaps the one uppermost in mind when verbal methods of education are attacked.

III. The Use of Language in its Educational Bearings

Language stands in a twofold relation to the work of education. On the one hand, it is continually used in all studies as well as in all the social discipline of the school; on the other, it is a distinct object of study. We shall consider only the ordinary use of language, since its effects upon habits

[1] See page 64.

of thought are much deeper than those of conscious linguistic study, for the latter only makes explicit what speech already contains.

The common statement that "language is the expression of thought" conveys only a half-truth, and a half-truth that is likely to result in positive error. Language does express thought, but not primarily, nor, at first, even consciously. The primary motive for language is to influence (through the expression of desire, emotion, and thought) the activity of others; its secondary use is to enter into more intimate sociable relations with them; its employment as a conscious vehicle of thought and knowledge is a tertiary, and relatively late, formation. The contrast is well brought out by the statement of John Locke that words have a double use, "civil" and "philosophical." "By their civil use, I mean such a communication of thoughts and ideas by words as may serve for the upholding of common conversation and commerce about the ordinary affairs and conveniences of civil life. . . . By the philosophical use of words, I mean such a use of them as may serve to convey the precise notions of things and to express in general propositions certain and undoubted truths."

Education Has to Transform Language into an Intellectual Tool

This distinction of the practical and social from the intellectual use of language throws much light on the problem of the school in respect to speech. That problem is *to direct pupils' oral and written speech, used primarily for practical and social ends, so that gradually it shall become a conscious tool of conveying knowledge and assisting thought.* How without checking the spontaneous, natural motives — motives to which language owes its vitality, force, vividness, and variety — are we to modify speech habits so as to

render them accurate and flexible *intellectual* instruments? It is comparatively easy to encourage the original spontaneous flow and not make language over into a servant of reflective thought; it is comparatively easy to check and almost destroy (so far as the schoolroom is concerned) native aim and interest and to set up artificial and formal modes of expression in some isolated and technical matters. The difficulty lies in making over habits that have to do with "ordinary affairs and conveniences" into habits concerned with "precise notions." The successful accomplishing of the transformation requires (*a*) enlarging the pupil's vocabulary, (*b*) rendering its terms more precise and accurate, and (*c*) forming habits of consecutive discourse.

a. Enlarging the Vocabulary. This takes place, of course, by wider intelligent contact with things and persons, and also vicariously, by gathering the meanings of words from the context in which they are heard or read. To grasp by either method a word in its meaning is to exercise intelligence, to perform an act of intelligent selection or analysis, and it is also to widen the fund of meanings or concepts readily available in further intellectual enterprises.[2] It is usual to distinguish between one's active and one's passive vocabulary, the latter being composed of the words that are understood when they are heard or seen, the former of words that are used intelligently. The fact that the passive is very much larger than the active vocabulary indicates power not controlled or utilized by the individual. Failure to use meanings that are understood may reveal dependence upon external stimulus and lack of intellectual initiative. This condition is to some extent an artificial product of education. Small children usually attempt to put to use every new word they get hold of, but when they learn to read they are introduced to a large variety of terms

[2] See pages 156–157

that they have no opportunity to use. The result is a kind of mental suppression, if not smothering. Moreover, the meaning of words not actively used in building up and conveying ideas is never quite clear-cut or complete. Action is required to make them definite.

While a limited vocabulary may be due to a limited range of experience, to a sphere of contact with persons and things so narrow as not to suggest or require a full store of words, it is also due to carelessness and vagueness. A happy-go-lucky frame of mind makes the individual averse to clear discriminations, either in perception or in his own speech. Words are used loosely in an indeterminate kind of reference to things, and speech approaches a condition where practically everything is just a 'thing-um-bob' or a 'what-do-you-call-it' a condition that reacts to make thought hopelessly loose and vague. Paucity of vocabulary on the part of those with whom the child associates, triviality and meagerness in the child's reading matter (as frequently even in his school readers and textbooks), tend to shut down the area of mental vision. Even technical terms become clear when they are used to make either an idea or an object clearer in meaning. Every self-respecting mechanic will call the parts of an automobile by their right names because that is the way to distinguish them. Simplicity should mean intelligibility, but not an approach to baby-talk.

We must note also the great difference between flow of words and command of language. Volubility is not necessarily a sign of a large vocabulary; much talking or even ready speech is quite compatible with moving round and round in a circle of moderate radius. Most schoolrooms suffer from a lack of materials and appliances save perhaps books — and even these are 'written down' to the supposed capacity, or incapacity, of children. Occasion and de-

mand for an enriched vocabulary are accordingly restricted. The vocabulary of things studied in the schoolroom is very largely isolated; it does not link itself organically to the range of the ideas and words that are in vogue outside the school. Hence the enlargement that takes place is often nominal, adding to the inert, rather than to the active, fund of meanings and terms.

b. Rendering the Vocabulary More Precise. One way in which the funds of words and concepts is increased is by discovering and naming shades of meaning — that is to say, by making the vocabulary more precise. Increase in definiteness is as important relatively as is the enlargement of the capital stock absolutely.

The first meanings of terms, since they are due to superficial acquaintance with things, are 'general' — in the sense of being vague. The little child calls all men 'papa'; acquainted with a dog, he may call the first horse he sees 'big dog.' Differences of quantity and intensity are noted, but the fundamental meaning is so vague that it covers things that are far apart. To many persons trees are just trees, being discriminated only into deciduous trees and evergreens, with perhaps recognition of one or two kinds of each. Such vagueness tends to persist and to become a barrier to the advance of thinking. Terms that are miscellaneous in scope are clumsy tools at best; in addition they are frequently treacherous, for their ambiguous reference causes us to confuse things that should be distinguished.

The growth of precise terms out of original vagueness takes place normally in two directions: first, toward words that stand for relationships, and second, toward words that stand for highly individualized traits;[3] the first is associated with abstract, the second with concrete, thinking. Some Australian tribes are said to have no words for *animal* or for

[3] Cf. what was said about the development of meanings, p. 142.

plant, while they have specific names for every variety of plant and animal in their neighborhoods. This minuteness of vocabulary represents progress toward definiteness, but in a one-sided way. Specific properties are distinguished, but not relationships.[4] On the other hand, students of philosophy and of the general aspects of natural and social science are apt to acquire a store of terms that signify relations, without balancing them up with terms that designate specific individuals and traits. The ordinary use of such terms as *causation, law, society, individual, capital,* illustrates this tendency.

In the history of language we find both aspects of the growth of vocabulary illustrated by changes in the sense of words: some words originally wide in their application are narrowed to denote shades of meaning; others originally specific are widened to express relationships. The term *vernacular,* now meaning mother speech, has been generalized from the word *verna,* meaning a slave born in the master's household. *Publication* has evolved its meaning of communication by means of print through restricting an earlier meaning of any kind of communication — although the wider meaning is retained in legal procedure, as publishing a libel. The sense of the word *average* has been generalized from a use connected with dividing loss by shipwreck proportionately among various sharers in an enterprise.[5]

These historical changes assist the educator to appreciate the changes that occur in individuals with advance in intellectual resources. In studying geometry, a pupil must

[4] The term *general* is itself an ambiguous term, meaning (in its best logical sense) the related and also (in its natural usage) the indefinite, the vague. *General,* in the first sense, denotes the discrimination of a principle or generic relation; in the second sense, it denotes the absence of discrimination of specific or individual properties.

[5] A large amount of material illustrating the twofold change in the sense of words will be found in Jevons, *Lessons in Logic.*

learn both to narrow and to extend the meanings of such familiar words as *line, surface, angle, square, circle* — to narrow them to the precise meanings involved in demonstrations, to extend them to cover generic relations not expressed in ordinary usage. Qualities of color and size must be excluded; relations of direction, of variation in direction, of limit, must be definitely seized. Thus in generalized geometry the idea of *line* does not carry any connotation of *length*. To it, what is ordinarily called a line is only a *section* of a line. A like transformation occurs in every subject of study. Just at this point lies the danger, alluded to above, of simply overlaying common meanings with new and isolated meanings instead of effecting a genuine working-over of popular and practical meanings into logical concepts.

Terms used with intentional exactness so as to express a meaning, the whole meaning, and only the meaning, are called *technical*. For educational purposes, a technical term indicates something relative, not absolute; for a term is technical, not because of its verbal form or its unusualness, but because it is employed to fix a meaning precisely. Ordinary words get a technical quality when used intentionally for this end. Whenever thought becomes more accurate, a (relatively) technical vocabulary grows up. Teachers are apt to oscillate between extremes in regard to technical terms. On the one hand, these are multiplied in every direction, seemingly on the assumption that learning a new piece of terminology, accompanied by verbal description or definition, is equivalent to grasping a new idea. On the other hand, when it is seen how largely the net outcome is the accumulation of an isolated set of words, a jargon or scholastic cant, and to what extent the natural power of judgment is clogged by this accumulation, there is a reaction to the opposite extreme. Technical terms are banished; 'name words' exist, but not nouns; 'action words,' but

not verbs; pupils may 'take away,' but not subtract; they may tell what four fives are, but not what four times five are, and so on. A sound instinct underlies this reaction — aversion to words that give the pretense, but not the reality, of meaning. Yet the fundamental difficulty is not with the word, but with the idea. If the idea is not grasped, nothing is gained by using a more familiar word; if the idea is grasped, the use of the term that exactly names it may assist in fixing the idea. Terms denoting highly exact meanings should be introduced only sparingly — that is, a few at a time; they should be led up to gradually, and great pains should be taken to secure the circumstances that render precision of meaning significant.

c. Forming Habits of Consecutive Discourse. As we saw, language connects and organizes meanings as well as selects and fixes them. As every meaning is set in the context of some situation, so every word in concrete use belongs to some sentence (it may itself represent a condensed sentence); and the sentence, in turn, belongs to some larger story, description, or reasoning process. It is unnecessary to repeat what has been said about the importance of continuity and ordering of meanings. We may, however, note some ways in which school practices tend to interrupt consecutiveness of language and thereby interfere harmfully with systematic reflection.

First, teachers have a habit of monopolizing continued discourse. Many, if not most, instructors would be surprised if informed at the end of the day of the amount of time they have talked as compared with any pupil. Children's conversation is often confined to answering questions in brief phrases or in single disconnected sentences. Expatiation and explanation are reserved for the teacher, who often admits any hint at an answer on the part of the pupil, and then amplifies what he supposes the child must have meant. The

habits of sporadic and fragmentary discourse thus promoted have inevitably a disintegrating intellectual influence.

Second, assignment of too short lessons, when accompanied (as it usually is in order to pass the time of the recitation period) by minute 'analytic' questioning, has the same effect. This evil is usually at its height in such subjects as history and literature, where not infrequently the material is so minutely subdivided as to break up the unity of meaning belonging to a given portion of the matter, to destroy perspective, and in effect to reduce the whole topic to an accumulation of disconnected details all upon the same level. More often than the teacher is aware, *his* mind carries and supplies the background of unity of meaning against which pupils project isolated scraps.

Third, insistence upon avoiding error instead of attaining power tends also to interruption of continuous discourse and thought. Children who begin with something to say and with intellectual eagerness to say it are sometimes made so conscious of minor errors in substance and form that the energy that should go into constructive thinking is diverted into anxiety not to make mistakes, and even, in extreme cases, into passive quiescence as the best method of minimizing error. This tendency is especially marked in connection with the writing of compositions, essays, and themes. It has even been gravely recommended that little children should always write on trivial subjects and in short sentences because in that way they are less likely to make mistakes. The teaching of high-school and college students occasionally reduces itself to a technique for detecting and designating mistakes. Self-consciousness and constraint follow. Students lose zest for writing. Instead of being interested in what they have to say and in how it is said as a means of adequate formulation and expression of their own thought, interest is drained off. Having to say something is a very different matter from having something to say.

CHAPTER SEVENTEEN

OBSERVATION AND INFORMATION IN THE TRAINING OF MIND

Thinking is ordering of subject matter with reference to discovering what it signifies or indicates. Thinking no more exists apart from this arranging of subject matter than digestion occurs apart from the assimilating of food. The way in which the subject matter is supplied and assimilated is, therefore, of fundamental importance. If the subject matter is provided in too scanty or too profuse fashion, if it comes in disordered array or in isolated scraps, the effect upon habits of thought is detrimental. If personal observation and the communication of information by others (whether in books or speech) are rightly conducted, half the logical battle is won, for these are the channels of obtaining subject matter, and the method in which they are carried on directly affects the habit of thinking. The effect is often deeper because it is so unconscious. The best digestion can be ruined by innutritious foodstuffs, by eating at the wrong time, too much at a time, or having an unbalanced diet — that is, one the materials of which are badly arranged.

I. The Nature and Value of Observation

Observation Not an End in Itself

The protest, mentioned in the last chapter, of educational reformers against the exaggerated and false use of language, insisted upon personal and direct observation as the alterna-

tive course. The reformers felt that the current emphasis upon the linguistic factor eliminated all opportunity for first-hand acquaintance with real things; hence they appealed to sense perception to fill the gap. It is not surprising that this enthusiastic zeal frequently failed to ask how and why observation is educative, and hence fell into the error of making observation an end in itself and hence was satisfied with any kind of material under any kind of conditions. Such isolation of observation is still manifested in the statement that this faculty develops first, then that of memory and imagination, and finally the faculty of thought. From this point of view, observation is regarded as furnishing crude masses of raw material, to which, later on, reflective processes may be applied. Our previous pages should have made obvious the fallacy of this point of view by bringing out the fact that simple concrete thinking attends all our intercourse with things that is not on a purely physical level.

Observation Impelled by Sympathetic Interest in Extending Acquaintance

All persons have a natural desire — akin to curiosity — for a widening of their range of acquaintance with persons and things. The sign in art galleries that forbids the carrying of canes and umbrellas is obvious testimony to the fact that simply to see is not enough for many people; there is a feeling of lack of acquaintance until some direct contact is made. This demand for fuller and closer knowledge is quite different from conscious interest in observation for its own sake. Desire for expansion, for ' self-realization,' is its motive. The interest is sympathetic, socially and æsthetically sympathetic, rather than cognitive. While the interest is especially keen in children (because their actual experience is so small and their possible experience so large), it still characterizes adults when routine has not blunted its edge. This

sympathetic interest provides the medium for carrying and binding together what would otherwise be a multitude of items, diverse, disconnected, and of no intellectual use. The result is a social and æsthetic organization rather than one consciously intellectual; but it provides the natural opportunity and supplies the material for conscious intellectual explorations. Some educators have recommended that nature study in the elementary schools be conducted with a love of nature and a cultivation of æsthetic appreciation in view rather than in a purely analytic spirit. Others have urged making much of the care of animals and plants. Both of these important recommendations have grown out of experience, not out of theory, but they afford an excellent exemplification of the point just made.

Analytic Observation Impelled by Need Arising in Activity: Some Fallacies about Sense-Training

In normal development, specific analytic observations are originally connected almost exclusively with the imperative need for noting means and ends in carrying on activities. When one is *doing* something *intelligently,* one is compelled, if the work is to succeed (unless it is purely routine), to use eyes, ears, and sense of touch as guides to action. Without a constant and alert exercise of the senses, not even plays and games can go on; in any form of work, materials, obstacles, appliances, failures, and successes must be intently watched. Sense perception does not occur for its own sake or for purposes of training, but because it is an indispensable factor of success in doing what one is trying to do. Although it is not designed for sense-training, this method effects sense-training in the most economical and thoroughgoing way. Various schemes have been designed by teachers for cultivating sharp and prompt observation of forms, as by writing words (even in an unknown language), making arrange-

ments of figures and geometrical forms, and having pupils reproduce them after a momentary glance. Children often attain great skill in quick seeing and full reproducing of even complicated meaningless combinations. But such methods of training, however valuable as occasional games and diversions, compare very unfavorably with the training of eye and hand that comes as an incident of work with tools in wood or metals, or such activities as gardening, cooking, or the care of animals. Training by isolated exercises leaves no deposit, leads nowhere; and even the technical skill acquired has little radiating power or transferable value. Criticisms made upon the training of observation, on the ground that many persons cannot correctly reproduce the forms and arrangement of the figures on the face of their watches, misses the point, because persons do not look at a watch to find out whether four o'clock is indicated by IIII or by IV, but to find out what time it is, and if observation decides this fact, noting other details is irrelevant and a waste of time. In the training of observation the question of purpose and result is all-important.

Observation Impelled by Solving Theoretical Problems

The further intellectual or scientific development of observation follows the line of the growth of practical into theoretical reflection already traced.[1] As problems emerge and are dwelt upon, observation is directed less to facts that bear upon a practical aim and more to what bears upon a problem as a problem. What often makes observation in schools intellectually ineffective is (more than anything else) that it is carried on without a sense of a problem that it helps define and solve. The evil of this isolation is seen through the entire educational system, from the kindergarten through the elementary and high schools to the college.

[1] See page 94.

Almost everywhere may be found, at some time, recourse to observations as if they were of complete and final value in themselves, instead of being means for getting the data that test an idea or plan and that make the felt difficulty into a question that guides subsequent thinking.[2] Moreover, intellectual method is violated because observations are not aroused and guided by any idea of the *purpose* they are to serve.

In the kindergarten observations are heaped up regarding geometrical forms, lines, surfaces, cubes, colors, and so on. In the elementary school, under the name of 'object-lessons,' the form and properties of objects — apple, orange, chalk — selected almost at random are minutely noted, while under the name of 'nature study' similar observations are directed upon leaves, stones, insects, selected in almost equally arbitrary fashion. In the high school and college, laboratory and microscopic observations are carried on as if the accumulation of observed facts and the acquisition of skill in manipulation were educational ends in themselves.

Observation in Scientific Work

Compare with these methods of isolated observations the statement of Jevons that observation as conducted by scientific men is effective "only when excited and guided by hope of verifying a theory"; and again, "the number of things which can be observed and experimented upon are infinite, and if we merely set to work to record facts without any distinct purpose, our records will have no value." Strictly speaking, the first statement of Jevons is too narrow. Scientific men institute observations not merely to test an idea (or suggested explanatory meaning), but also to locate a problem or even create one and thereby guide the formation of a hypothesis. But the principle of his remark — namely,

[2] See page 108.

that scientific men never make the accumulation of observations an end in itself, but always a means to a general intellectual conclusion — is absolutely sound. Until the force of this principle is adequately recognized in education, observation will be largely a matter of uninteresting dead work or of acquiring forms of technical skill that are not available as intellectual resourses.

II. Methods and Materials of Observation in the Schools

The best methods already in use in schools furnish many suggestions for giving observation its right place in mental training. Three features of these methods deserve mention.

Observation Should Involve Active Exploration

First, they rest upon the sound assumption that observation is an *active* process. Observation is exploration, inquiry for the sake of discovering something previously hidden and unknown, this something being needed in order to reach some end, practical or theoretical. Observation is to be discriminated from recognition, the perception of what is familiar. The identification of something already understood is, indeed, an indispensable function of further investigation[3]; but it is relatively automatic and passive, while observation demands the mind to be alert, on the *qui vive*, searching and probing. Recognition deals with the already mastered; observation is concerned with delving into the unknown. The common notions that perception is like writing on a blank piece of paper or like impressing an image on the mind as a seal is imprinted on wax or as a picture is formed on a photographic plate (notions that have played a disas-

[3] See page 139.

trous rôle in educational methods) arise from a failure to distinguish between automatic recognition and live observation.

Observation Should Introduce the Dramatic Element of Suspense, of 'Plot Interest'

Second, much assistance in the selection of appropriate material for observation may be derived from considering the eagerness and closeness of observation that attend the following of a story or drama. Alertness of observation is at its height wherever there is 'plot interest.' Why? Because of the balanced combination of the old and the new, of the familiar and the unexpected. We hang on the lips of the story-teller because of the element of mental suspense. Alternatives are suggested, but are left ambiguous, so that our whole being questions: What befell next? Which way did things turn out? Contrast the ease and fullness with which a child notes all the salient traits of a story, with the labor and inadequacy of his observation of some dead and static thing where nothing raises a question or suggests alternative outcomes.

When an individual is engaged in doing or making something (the activity not being of such a mechanical and habitual character that its outcome is assured), there is an analogous situation. Something is going to come of what is present to the sense, but just what is doubtful. The plot is unfolding toward success or failure, but just when or how is uncertain. Hence the keen and tense observation of conditions and results that attends constructive manual operations. Where the subject matter is of a more impersonal sort, the same principle of movement toward a dénouement may apply. It is a commonplace that what is moving attracts notice when that which is at rest escapes it. Yet too often it would seem as if pains were taken to deprive the material

of school observations of all life and dramatic quality, to reduce it to a dead and inert form. Mere change is not enough, however. Vicissitude, alteration, motion, excite observation; but if they merely excite it, there is no thought. The changes must (like the incidents of a well-arranged story or plot) take place in a certain cumulative order; each successive change must at once remind us of its predecessor and arouse interest in its successor if observations of change are to be intellectually ordered and thus are to aid in forming a logical attitude.

Observation of Structure and Function. Living beings, plants and animals, fulfill the twofold requirement to an extraordinary degree. Where there is growth, there is motion, change, process; and there is also arrangement of the changes in a cycle. The first arouses thought; the second organizes it. Much of the extraordinary interest that children take in planting seeds and watching the stages of their growth is due to the fact that a drama is enacting before their eyes; there is something doing, each step of which is important in the destiny of the plant. The great practical improvements that have occurred of late years in the teaching of botany and zoölogy will be found, upon inspection, to involve treating plants and animals as beings that act, that do something, instead of as mere inert specimens having static properties to be inventoried, named, and registered. Treated in the latter fashion, observation is inevitably reduced to the falsely 'analytic,'[4] to mere enumeration and cataloguing.

There is, of course, a place, and an important place, for observation of the static qualities of objects. When, however, the primary interest is in *function,* in what the object does and how it operates, there is a motive for more minute analytic study, for observation of *structure.* Interest in not-

[4] See page 127.

ing an activity passes insensibly into noting how the activity is carried on; the interest in what is done passes over into an interest in the organs by which it is done. But when the beginning is made with the morphological, the anatomical, the noting of peculiarities of form, size, color, and distribution of parts, the material is cut off from significance and becomes dead and dull. It is as natural for children to look intently for the *stomata* of a plant after they have learned that, like animals, it breathes, and so must have something corresponding in function to lungs. It is repulsive to attend minutely to them when they are presented for study as mere items of structure, and no idea of their action and use is conveyed.

Observation Should Become Scientific in Nature

Third, observation that is carried on at first to help out a practical purpose or for the mere fun of seeing and hearing comes to be conducted for an intellectual purpose. Pupils learn to observe for the sake (*a*) of finding out what sort of perplexity confronts them; (*b*) of conjecturing and inventing hypothetical explanations for the puzzling features revealed by observation; and (*c*) of testing the ideas thus suggested.

In short, observation becomes scientific in nature. Of such observations it may be said that they should follow a rhythm between the extensive and the intensive. Problems become definite, and suggested explanations significant by an alternation between a wide and loose soaking in of relevant facts and a minutely accurate study of a few selected facts. The wider, less exact observation is necessary to give the student a feeling for the reality of the field of inquiry, a sense of its bearings and possibilities, and to store his mind with materials that imagination may transform into suggestions. The intensive study is necessary for limiting the prob-

lem and for securing the conditions of experimental testing. As the latter by itself is too specialized and technical to arouse intellectual growth, the former by itself is too superficial and scattering for control of intellectual development. In the sciences of life, field study, excursions, acquaintance with living things in their natural habitats, may alternate with microscopic and laboratory observation. In the physical sciences, phenomena of light, of heat, of electricity, of moisture, of gravity, in their broad setting in nature — their physiographic setting — should prepare for an exact study of selected facts under conditions of laboratory control. In this way, the student gets the benefit of technical scientific methods of discovery and testing, while he retains his sense of the identity of the laboratory modes of energy with large out-of-door realities, thereby avoiding the impression (that so often accrues) that the facts studied are peculiar to the laboratory. Scientific observation does not, however, merely replace observation that is enjoyed for its own sake. The latter, sharpened by the purpose of contributing to an art like writing, painting, singing, becomes truly esthetic, and the persons who enjoy seeing and hearing will be the best observers.

III. Communication of Information

When all is said and done, the field of fact open to any one observer by himself is narrow. Into every one of our beliefs, even those that we have worked out under the conditions of utmost personal, first-hand acquaintance, much has insensibly entered from what we have heard or read of the observations and conclusions of others. In spite of the great extension of direct observation in our schools, the vast bulk of educational subject matter is derived from other sources — from textbook, lecture, and *viva voce* interchange. No

educational question is of greater import than how to get *intellectual* good out of what persons and books have to communicate.

How to Make an Intellectual Asset of Learning through Communicated Information

Doubtless the chief meaning associated with the word *instruction* is this conveying and instilling of the results of the observations and inferences of others. Doubtless the undue prominence in education of the ideal of amassing information [5] has its source in the prominence of the learning of other persons. The problem, then, is how to convert this form of learning into an intellectual asset. In logical terms, the material supplied from the experience of others is *testimony:* that is to say, *evidence* submitted by others that is to be employed by one's own judgment in reaching a conclusion. How shall we treat subject matter that is supplied by textbook and teacher so that it shall rank as material of reflective inquiry, not as ready-made intellectual pabulum to be accepted and swallowed just as if it were something bought at a shop?

In reply to this question, we may say first, that communication of material should be *needed.* That is to say, it should be such as cannot readily be attained by personal observation. For teacher or book to cram pupils with facts which, with little more trouble, they could discover by direct inquiry is to violate their intellectual integrity and to cultivate mental servility. This does not mean that the material supplied through communication of others should be meager or scanty. With the utmost range of the senses, the world of nature and history stretches out almost infinitely beyond. But fields within which direct observation is practicable should be carefully chosen and sacredly protected. Curiosity

[5] See page 64.

should not be dulled by making its satisfaction cheap and stale.

Second, material should be supplied by way of stimulus, not with dogmatic finality and rigidity. When pupils get the notion that any field of study has been definitely surveyed, that knowledge about it is exhaustive and final, they may become docile pupils, but they cease to be students. All thinking whatsoever — so be it *is* thinking — contains a phase of originality. This originality does not imply that the student's conclusion varies from the conclusions of others, much less that it is a radically novel conclusion. His originality is not incompatible with large use of materials and suggestions contributed by others. Originality means personal interest in the question, personal initiative in turning over the suggestions furnished by others, and sincerity in following them out to a tested conclusion. Literally, the phrase 'Think for yourself' is tautological; any thinking is thinking for one's self.

Third, the material furnished by way of information should be relevant to a question that is vital in the student's own experience. What has been said about the evil of observations that begin and end in themselves may be transferred without change to communicated learning. Instruction in subject matter that does not fit into an interest already stirring in the student's own experience or that is not presented in such a way as to arouse a problem is worse than useless for intellectual purposes. In that it fails to enter into any process of reflection, it is useless; in that it remains in the mind as so much lumber and débris, it is a barrier, an obstruction in the way of effective thinking when a problem arises.

Another way of stating the same principle is that material furnished by communication must be such as to enter into some existing system or organization of experience. All stu-

dents of psychology are familiar with the principle of apperception — that we assimilate new material with what we have digested and retained from prior experiences. Now the apperceptive basis of material furnished by teacher and textbook should be found, as far as possible, in what the learner has derived from more direct forms of his own experience. There is a tendency to connect material of the schoolroom simply with the material of prior school lessons, instead of linking it to what the pupil has acquired in his out-of-school experience. The teacher says, "Do you not remember what we learned from the book last week?" — instead of saying, "Do you not recall such and such a thing that you have seen or heard?" As a result, there are built up detached and independent systems of school knowledge that inertly overlay the ordinary systems of experience instead of reacting to enlarge and refine them. Pupils are taught to live in two separate worlds, one the world of out-of-school experience, the other the world of books and lessons. Then we stupidly wonder why what is studied in school counts so little outside.

CHAPTER EIGHTEEN

THE RECITATION AND THE TRAINING OF THOUGHT

I. False Ideas about the Recitation

In the recitation the teacher comes into his closest contact with the pupil. In the recitation focus the possibilities of guiding children's activities, arousing eagerness for information, influencing language habits, and directing observations. In discussing the significance of the recitation as an instrumentality of education, we are accordingly bringing to a head the points considered in the last three chapters, rather than introducing a new topic. The method in which the recitation is carried on is a crucial test of a teacher's ability to diagnose the intellectual state of his pupils and to supply the conditions that will arouse intellectual responses: a crucial test, in short, of his art as a teacher.

Re-Citing *versus* Reflecting

The use of the word ' recitation ' to designate the period of the most intimate intellectual contact of teacher with pupil and of pupil with pupil is a fateful fact. To *re-cite* is to cite again, to repeat, to tell over and over. If we were to call this period ' reiteration,' the name would hardly bring out more clearly than does the word ' recitation ' the frequent domination of instruction by rehearsal of secondhand information, and of memorizing for the sake of producing correct replies at the proper time. Everything which is said in this chapter is insignificant in comparison with the basic truth

that the recitation is the place and time for stimulating and directing reflection. Reproduction of memorized matter is only an incident — even though an indispensable incident — in the business of cultivating a thoughtful attitude.

The recitation exhibits, more definitely than anything else in the school system, the domination of the ideal of amassing information without a purpose for it, because information would help master a difficulty, and without judgment in selection of what is pertinent. It is hardly an exaggeration to say that too often the pupil is treated as if he were a phonographic record on which is impressed a set of words that are to be literally reproduced when the recitation or examination presses the proper lever. Or, varying the metaphor, the mind of the pupil is treated as if it were a cistern into which information is conducted by one set of pipes that mechanically pour it in, while the recitation is the pump that brings out the material again through another set of pipes. Then the skill of the teacher is rated by his or her ability in managing the two pipe-lines of flow inward and outward.

The Evils of Passivity

It does not need to be mentioned that this practice puts a premium on passivity of mind. Everything which has been said in the discussion of thinking has emphasized that passivity is the opposite of thought; that it is not only a sign of failure to call out judgment and personal understanding, but that it also dulls curiosity, generates mind-wandering, and causes learning to be a task instead of a delight. It does not in most cases even serve the purpose of storing the mind with a subject matter of facts and principles that are available when they are needed. The mind is not a piece of blotting paper that absorbs and retains automatically. It is rather a living organism that has to search for its food, that selects and rejects according to its present conditions and

needs, and that retains only what it digests and transmutes into part of the energy of its own being.

II. The Functions of the Recitation

What are the objects that the recitation should achieve? In general, they are these three: (1) It should stimulate intellectual eagerness, awaken an intensified desire for intelligent activity and knowledge, and love of study — attitudes that are essentially *emotional* in character. (2) In case pupils bring these interests and affections with them and in the degree in which they are aroused, the recitation should *guide* them into those channels in which they can accomplish intellectual work, just as the great potential force of a river has to be directed into a particular course in order to grind grain or to convert water power into electric energy. (3) It should assist in organizing what has been acquired, so as to *test* its quality and quantity, and test especially the existing attitudes and habits with a view to ensuring their greater efficiency in the future.

These three functions, or objects, of the recitation are worth more extended consideration.

The Recitation Should Stimulate Intellectual Eagerness

The ultimate impetus to study, to intellectual activity comes from within. Mentally as well as physically there must be an appetite. For there is intellectual as well as bodily hunger and thirst. Yet the food stuffs of the *environment,* either those directly at hand or those found by search, finally determine what is eaten. That is, they decide what *direction* the appetite actually takes. So stimulus from without, especially that which occurs in a social situation, decides the further movement of an intellectual impetus. An

infant has to have an impetus from within in order to learn to talk; it babbles, gestures, etc. These at first are formless and diffuse movements. Contact with others stimulates them to take on *meaning*, intellectual import.

A recitation should be a situation in which a class, a group organized as a social unity, with common interests, led by a more mature and experienced person, encourages mental eagerness. A pupil may come to the class intellectually empty and lethargic. Or his intellectual interests may be remote from the subject at hand. It is the business of the recitation period to stir up the mind, to get it going, as it were, to impart by contagion some degree of intellectual excitement. The statement is sometimes made that there have been teachers with no training in the theory of teaching, no scientific knowledge of psychology, etc., who nevertheless were great teachers, some of them much greater teachers than those who have had a full equipment of pedagogical courses. If the reader will go back over his own school experience, he will probably have no trouble in discovering the why and wherefore of this fact. He will note that the teachers who left the most enduring impression were those who awakened in him a new intellectual interest, who communicated to him some of their own enthusiasm for a field of knowledge or art, who gave his desire to inquire and find out a momentum of its own. This is the one thing most needful. Given this hunger, the mind will go on; while it may be stuffed to overflowing with information, if this one thing is omitted, little will be gained in the future.

The conditions to be met in communicating ardor in study have been indicated in various places in prior discussions. The teacher must have a genuine interest in mental activity on his own account, a love of knowledge that unconsciously animates his teaching. A bored, perfunctory instructor will

deaden any subject. Again, textbooks must be used as means and tools, not as ends. They are useful to arouse questions and to supply information with which to answer them. But when they are permitted to dictate or even dominate the conduct of the recitation, the result is a dulling of thought. As a rule, the material of the text should be attacked indirectly, by a flank movement. It is the literal approach that confines the mind to the paths already trodden in the book. But such prerequisites as these sum themselves up in the fact that a lively give-and-take of ideas, experiences, information, between the members of the class should be the chief reliance.

A vital discussion will make the underlying problems stand out in sharply defined focus. Instead of treating all facts and statements as on the same intellectual level, thus destroying intellectual perspective, and hence giving no opportunity for judgment to appraise what is important and what secondary, the discussion should be conducted so as to center thought on a few main points around which other considerations will be organized. It will lead the student to turn back and go over what he has learned from his prior personal experiences and what he has learned from others (to reflect), so as to find out what bears, both positively and negatively, on the subject in hand. Although discussion will not be allowed to degenerate into mere 'argufying,' a lively discussion will bring out intellectual differences and opposed points of view and interpretations, so as to help define the true nature of the problem. Humor is always in place, as well as sympathy for the pupil struggling with an idea that he has difficulty in laying hold of.

The Recitation Should Guide Pupils to Good Habits of Study

Since stimulation and direction should occur simultaneously, we have touched upon this function in what has just

been said. From the standpoint of direction, the point to be emphasized is that the recitation culminate, from the intellectual standpoint, in the promotion of *good habits of study*. Instead of repeating, we shall, then, say something about study.

In substance, study is simply reflective activity with especial emphasis on matter provided through language, oral or printed. The expression 'a studious person' suggests a person who is fond of books that have a substantial mental content. At the same time, as the colloquial phrase 'studying something *out*' suggests, one 'studies' machinery, financial and political situations, questions of personal conduct and character. A person's automobile will not run; he 'studies out' the trouble; he puzzles over it to locate the cause of the trouble. It is obvious that this active process of search, ending in *understanding*, is very different from repeating over and over the statements of a book or lecture notes in order to impress them firmly on memory with a view to recalling them later on demand.

Thinking is inquiry, investigation, turning over, probing or delving into, so as to find something new or to see what is already known in a different light. In short, it is *questioning*. A well established feature of the traditional recitation is the asking of questions by the teacher. But too often they are asked merely to get an answer, not to *raise* a question for discussion by teacher and students in common. The fact is that the separation usually made between a preparatory 'study' period, when pupils con their lessons, and a recitation period, when they exhibit the results of their previous study, is thoroughly harmful. Students need direction in their studying. Hence some so-called 'recitation' periods should be times of supervised study, when the teacher learns the difficulties that students are meeting, ascertains what methods of learning they use, gives hints and suggestions,

helps a student recognize some bad habit that is holding him back. In *all* cases, the recitation should be a *continuation* of the study period, following up what has been done and leading on to further independent study.

The Art of Questioning. The art of conducting a recitation is, then, very largely the art of questioning pupils so as to direct their own inquiries and so as to form in them the independent habit of inquiry in both of its directions; namely, inquiry in *observation* and recollection for the subject matter that is pertinent and inquiry through *reasoning* into the *meaning* of material that is present. The art of questioning is so fully the art of guiding learning that hard and fast rules cannot be laid down for its exercise. Some suggestions follow.

First, in reference to material already learned, questions should require the student to *use* it in dealing with a new problem rather than to reproduce it literally and directly. For the former operation demands the exercise of judgment by the pupil and cultivates originality even in dealing with things already well known by others. Students in an advanced class who had been studying the snake, including its dissection, were asked in a written test: How does the snake move along the ground? They were already informed about the muscular system and skeleton; the question compelled them to *use* that information, to imagine the structure of the snake actually operating, to see in thought the muscles in action. There are times, however, when questions asking for direct reproduction of material are in place. When a problem is already under active consideration, and a student is blundering around aimlessly, he may be checked and called back to the topic by being asked to state as precisely as possible just the facts and principle that bear upon it.

Second, questions should direct the mind of students to

subject matter rather than to the teacher's aim. This principle is violated when emphasis falls chiefly on getting the correct answer.[1] Then the recitation tends to become a guessing bee as to what the teacher is really after.

Third, questions should be such as keep the subject developing. That is, they should be factors in a continuous discussion, not asked as if each one were complete in itself so that when that question is answered that particular matter is disposed of and another topic can be taken up. The failure to get a *situation* before the thought of students, and a situation that is large, inclusive, enough to have a movement within it from one point to another in a consecutive way,[2] breaks the continuity of ideas and renders thought choppy and disorderly.

Fourth, questions should periodically require a survey and review of what has been gone over, in order to extract its *net* meaning, to gather up and hold on to what is significant in the prior discussion and to make it stand out from side issues, from tentative and explorative remarks, etc. The recitation should usually include two or three minor organizing surveys in order to keep discussion to a point and prevent its rambling on aimlessly, 'wandering all over the lot,' as we say. Then there should be occasional recurrent summaries of extensive stretches of previous recitations so as to put the old material in the new perspective that later material has supplied.

Fifth, and finally, while recitations should at their close provide a sense of what has been accomplished and learned, the minds of pupils should even more be put on the *qui vive* through a sense of some *coming* topic, some problem still in suspense, just as in a cleverly constructed story or drama each section leaves the mind looking ahead, eager to resume the thread. There is an old story to the effect that the

[1] See page 47.

[2] See page 65.

way to educate a baby is to begin with the grandparents. It may be said with more practicability that the way to arouse the mind, to awaken it to activity in any particular case, is to make sure that desire to go on has been left as a deposit by prior recitations.

The Recitation Should Test What Has Been Acquired

There is not much additional to be said on the score of the third function of the recitation, testing. Testing should be a constant function. The mistake lies in supposing that the need for testing is met merely by tests of ability to reproduce subject matter that has been committed to memory. The previous discussion shows that that object is incidental. The important thing is to test (*a*) progress in *understanding subject matter*, (*b*) *ability to use what has been learned* as an instrumentality of further study and learning, (*c*) improvement in the general habits and attitudes that underlie thinking: curiosity, orderliness, power to review, to sum up, and to define, openness and honesty of mind, etc.

III. The Conduct of the Recitation

We shall now go over the material already stated by considering the conduct of the recitation as a unity.

The First Need: Preparation of Pupils

The first need is readiness, preparation on the part of students. The best, indeed the only, preparation needed is arousal to a perception of something that needs explanation, something unexpected, puzzling, peculiar. When the feeling of a genuine perplexity lays hold of any mind (no matter how the feeling arises), that mind is alert and inquiring, because stimulated from within. The shock, the bite, of a ques-

tion will force the mind to go wherever it is capable of going, better than will the most ingenious pedagogical devices unaccompanied by this mental ardor. It is the sense of a problem to be mastered, a purpose to be realized, that forces the mind to a survey and recall of the past to discover what the question means and how it may be dealt with.

The teacher, in his more deliberate attempts to call into play the familiar elements in a student's experience, must guard against certain dangers. First, the step of preparation must not be too long continued or too exhaustive, or it defeats its own end. The pupil loses interest and is bored, whereas a plunge *in medias res* might have braced him to his work. The preparation part of the recitation period of some conscientious teachers reminds one of the boy who takes so long a run in order to gain headway for a jump that, when he reaches the line, he is too tired to jump far. Second, the organs by which we apprehend new material are our habits. To insist too minutely upon turning over habitual dispositions into conscious ideas is to interfere with their best workings. Some factors of familiar experience must indeed be brought to conscious recognition, just as transplanting is necessary for the best growth of some plants. But it is fatal to be forever digging up either experiences or plants to see how they are getting along. There is no mistake more common in schools than ignoring the self-propelling power of an idea. Once it is aroused, an alert mind fairly races along with it. Of itself it carries the student into new fields; it branches out into new ideas as a plant sends forth new shoots.

The Degree of Participation by the Teacher

The practical question of how much new subject matter the teacher should introduce in the course of a discussion was taken up in one of its aspects when we were discussing

the place of information. In some quarters, however, the fear lest the adult instructor make the young pupil unduly dependent on others has led to a morbid fear of the teacher's taking an active part in the class. The practical problem of the teacher is to preserve a balance between so little showing and telling as to fail to stimulate reflection and so much as to choke thought. Provided the student is genuinely engaged upon a topic, and provided the teacher is willing to give the student a good deal of leeway as to what he assimilates and retains (not requiring rigidly that everything be grasped or reproduced), there is comparatively little danger that one who is himself enthusiastic will communicate too much concerning a topic. If a genuine community spirit pervades the group, if the atmosphere is that of free communication in a developing exchange of experiences and suggestions, it is absurd to debar the teacher from the privilege and responsibility freely granted to the young, that of contributing his share. The only warning is that the teacher should not forestall the contributions of pupils, but should enter especially at the critical junctures where the experience of pupils is too limited to supply just the material needed.

The objection most commonly brought against the type of free social discussion here recommended is that it becomes aimless, and gets nowhere, that discussion is dispersive, children jumping from one thing to another, till unity is destroyed and pupils are left with a sense of futility. There is no doubt of the reality of the danger thus suggested. But if the young are to be prepared when they leave school to take an effective part in a democratic society, the danger must be faced and conquered. Many of the failures of democratic government (which are used by critics to condemn the whole undertaking) are due to the fact that adults are unable to share in joint conference and consultation on so-

cial questions and issues. They can neither contribute intelligently, nor can they follow and judge the contributions of others. The habits set up in their earlier schooling have not fitted them for this enterprise; the habits even stand in the way.

Making the Pupil Justify His Contributions

One of the most important factors in preventing an aimless and discursive recitation consists in making it necessary for every student to follow up and justify the suggestions he offers. He should be held responsible for working out mentally every suggested principle so as to show what he means by it, how it bears upon the facts at hand, and how the facts bear upon it. Unless the pupil is made responsible for developing on his own account the *reasonableness* of the guess he puts forth, the recitation counts for practically nothing in the training of reasoning power. A clever teacher easily acquires great skill in dropping out the inept and senseless contributions of pupils, and in selecting and emphasizing those in line with the result he wishes to reach. But this method (sometimes called 'suggestive questioning') relieves the pupils of intellectual responsibility, save for acrobatic agility of mind in following the teacher's lead.

The working over of a vague and more or less casual idea into coherent and definite form is impossible without a pause, without freedom from distraction. We say, "Stop and think"; well, all reflection involves, at some point, stopping external observations and reactions so that an idea may mature. Meditation, withdrawal or abstraction from clamorous assailants of the senses and from demands for overt action, is as necessary at the reasoning stage as are observation and experiment at other periods. The metaphors of digestion and assimilation, which so readily occur to mind in connection with rational elaboration, are highly instruc-

tive. A silent, uninterrupted working-over of considerations by comparing and weighing alternative suggestions is indispensable for the development of coherent and compact conclusions. Reasoning is no more akin to disputing or arguing or to the abrupt seizing and dropping of suggestions than digestion is to a noisy champing of the jaws. The teacher must permit opportunity for leisurely mental digestion.

The holding, metaphorically, of a stop-watch over students in a recitation, exacting prompt and speedy responses from them, is not conducive to building up a reflective habit of mind.

Avoiding Distraction by Focussing upon a Central Topic or Typical Object

The teacher must avert the distraction that ensues from putting before the mind a number of facts on the same level of importance. Since attention is selective, some one object normally claims thought and furnishes the center of departure and reference. This fact is fatal to the success of the pedagogical methods that put before the mind a row of objects of equal importance. In reaching a generalization the mind does not naturally begin with objects *a, b, c, d,* and try to find the respect in which they agree. It begins with a single object or situation, more or less vague and inchoate in meaning, and makes excursions to other objects in order to render understanding of the central object consistent and clear. A mere multiplication of objects is adverse to successful reasoning. Each fact brought within the field of thought should clear up some obscure feature or extend some fragmentary trait of the primary object.

In short, pains should be taken to see that the object on which thought centers is *typical.* Material is typical when, although individual or specific, it is such as readily and fruitfully suggests the principles of an entire class of facts.

No sane person, for example, begins to think about rivers wholesale or at large. He begins with the one river that has presented some puzzling trait. Then he studies other rivers to get light upon the baffling features of this one, and at the same time he employs the characteristic traits of his original object to reduce to order the multifarious details that appear in connection with other rivers. This working back and forth preserves unity of meaning, while protecting it from monotony and narrowness. The mind needs to be defended against the deadening influence of many isolated particulars and also against the barrenness of a merely formal principle. The inherent significance of generalization is that it frees a meaning from local restrictions; generalization *is* meaning so freed; it is meaning emancipated from accidental features so as to be available in new cases. The surest test for detecting a spurious generalization (a statement general in verbal form but not accompanied by discernment of meaning) is the failure of the so-called 'principle' spontaneously to extend itself. A central idea moves of its own accord to application; it seeks opportunity for operation in use to bring other facts into line.[3]

IV. The Function of the Teacher

The Teacher as Leader

The older type of instruction tended to treat the teacher as a dictatorial ruler. The newer type sometimes treats the teacher as a negligible factor, almost as an evil, though a necessary one. In reality the teacher is the intellectual leader of a social group. He is a leader, not in virtue of official position, but because of wider and deeper knowledge and matured experience. The supposition that the principle of

[3] See page 187.

freedom confers liberty upon the pupils, but that the teacher is outside its range and must abdicate all leadership is merely silly.

Fallacious Notions Minimizing His Leadership

In some schools the tendency to minimize the place of the teacher takes the form of supposing that it is an arbitrary imposition for the teacher to propose the line of work to be followed or to arrange the situation within which problems and topics arise. It is held that, out of due respect for the mental freedom of those taught, all suggestions are to come from them. Especially has this idea been applied in some kindergartens and primary grades. The result is often that described in the story of a young child who, on arriving at school, said to the teacher: "Do we have to do to-day what we want to do?" The alternative to proposals by the teacher is that the suggestions of things to do come from chance, from casual contacts, from what the child saw on his way to school, what he did yesterday, what he sees the next child doing, etc. Since the purpose to be carried out must come, directly or indirectly, from somewhere in the environment, denial to the teacher of the power to propose it merely substitutes accidental contact with some other person or scene for the intelligent planning of the very individual who, if he has a right to be a teacher at all, has the best knowledge of the needs and possibilities of the members of the group of which he is a part.

His Need of Abundant Knowledge

The practically important question concerns the conditions under which the teacher can really be the intellectual leader of a social group. The first condition goes back to his own intellectual preparation in subject matter. This should be abundant to the point of overflow. It must be much wider

than the ground laid out in textbook or in any fixed plan for teaching a lesson. It must cover collateral points, so that the teacher can take advantage of unexpected questions or unanticipated incidents. It must be accompanied by a genuine enthusiasm for the subject that will communicate itself contagiously to pupils.

Some of the reasons why the teacher should have an excess supply of information and understanding are too obvious to need mention. The central reason is possibly not always recognized. *The teacher must have his mind free to observe the mental responses and movements of the student members of the recitation-group.* The problem of the pupils is found in *subject matter;* the problem of teachers is *what the minds of pupils are doing with this subject matter.* Unless the teacher's mind has mastered the subject matter in advance, unless it is thoroughly at home in it, using it unconsciously without the need of express thought, he will not be free to give full time and attention to observation and interpretation of the pupils' intellectual reactions. The teacher must be alive to all forms of bodily expression of mental condition — to puzzlement, boredom, mastery, the dawn of an idea, feigned attention, tendency to show off, to dominate discussion because of egotism, etc. — as well as sensitive to the meaning of all expression in words. He must be aware not only of *their* meaning, but of their meaning as indicative of the state of mind of the pupil, his degree of observation and comprehension.

His Need of Technical, Professional Knowledge

The fact that the teacher has to be a student of the pupil's mind, as the latter is a student of subject matter in various fields, accounts for the teacher's need for technical knowledge as well as for knowledge in the subjects taught. By 'technical knowledge' is here meant professional knowl-

edge. Why should a teacher have acquaintance with psychology, history of education, the methods found helpful by others in teaching various subjects? For two main reasons: the one reason is that he may be equipped to note what would otherwise go unheeded in the responses of the students and may quickly and correctly interpret what pupils do and say; the other reason is that he may be ready to give proper aid when needed because of his knowledge of procedures that others have found useful.

Unfortunately this professional knowledge is sometimes treated, not as a guide and tool in personal observation and judgment — which it essentially is — but as a set of fixed rules of procedure in action. When a teacher finds such theoretical knowledge coming between him and his own common-sense judgment of a situation, the wise thing is to follow his own judgment — making sure, of course, that it is an enlightened insight. For unless the professional information enlightens his own perception of the situation and what to do about it, it becomes either a purely mechanical device or else a load of undigested material.

Finally the teacher, in order to be a leader, must make special preparation for particular lessons. Otherwise the only alternatives will be either aimless drift or else sticking literally to the text. Flexibility, ability to take advantage of unexpected incidents and questions, depends upon the teacher's coming to the subject with freshness and fullness of interest and knowledge. There are questions that he should ask before the recitation commences. What do the minds of pupils bring to the topic from their previous experience and study? How can I help them make connections? What need, even if unrecognized by them, will furnish a leverage by which to move their minds in the desired direction? What uses and applications will clarify the subject and fix it in their minds? How can the topic be individu-

alized; that is, how shall it be treated so that each one will have something distinctive to contribute while the subject is also adapted to the special deficiencies and particular tastes of each one?

V. Appreciation

The Realization of Value

To experience a thing fully is in familiar phrase to get a 'realizing sense' of it; or, in synonymous expressions, to have it come home to one, to have it take possession. When this happens, the person is 'warm,' as children say in their searching games. Barriers and obstructions that have previously come between the mind and some object, truth, or situation, fall away. The mind and the subject seem to come together and unite. This is the state of affairs that is designated by the word 'appreciation.' We sometimes speak of things 'appreciating' in value, the opposite being 'depreciation' as objects grow stale, out of date, and wanted by no one. When the mind thoroughly appreciates anything, that object is experienced with heightened intensity of value. There is no inherent opposition between thought, knowledge, and appreciation. There is, however, a definite opposition between an idea or a fact grasped *merely* intellectually and the idea or fact which is *emotionally* colored because it is felt to be connected with the needs and satisfactions of the whole personality. In the latter case, it has immediate value; that is, it is *appreciated.*

Its Rôle in Thinking

In what has been said throughout the book about the necessity of situations and problems that are vitally real to

students [4] it has been implied that no separation exists between thinking and realization, between intellectual activity and appreciation. This implicit idea will now be briefly considered with the purpose of making explicit the basic importance of appreciation to thought.

There is a tendency in schools that are breaking away from traditional methods of routine discipline, of drill and literal reproduction of subject matter, to make a sharp separation between subjects that involve mastery of facts and principles (like arithmetic, grammar, physical science, the larger part of geography) on the one side, and literature, music, and the fine arts on the other side. The need for personal appreciation is supposed to be confined to the latter group of subjects. When this idea is acted upon, the latter subjects tend to become sentimental and imaginative (in the sense of merely imaginary and unreal), while freedom of self-expression turns into something that might better be called 'self-exposure.'

The evil that especially concerns us in this connection, however, is failure to see that vital appreciations — that is, ideas involving emotional response and imaginative projection — are ultimately as necessary in history, mathematics, scientific fields, in all so-called 'informational' and 'intellectual' subjects, as they are in literature and the fine arts. Human beings are not normally divided into two parts, the one emotional, the other coldly intellectual — the one matter of fact, the other imaginative. The split does, indeed, often get established, but that is always because of false methods of education. Natively and normally the personality works as a whole. There is no integration of character and mind unless there is fusion of the intellectual and the emotional, of meaning and value, of fact and imaginative running beyond fact into the realm of desired possibilities.

[4] For example, on pages 99–100.

The final test of any recitation in any subject is the extent in which pupils secure vital appreciation of the subject matter dealt with. Otherwise problems and questions, which are the only true instigators of reflective activity, will be more or less externally imposed and only half-heartedly felt and dealt with.

CHAPTER NINETEEN

SOME GENERAL CONCLUSIONS

We shall conclude our survey of how we think and how we should think by presenting some factors of thinking that should balance each other, but that constantly tend to become so isolated that they work against each other instead of coöperating to make reflective inquiry efficient.

I. The Unconscious and the Conscious

Implicit and Explicit Context

It is significant that one meaning of the term 'understood' is something so thoroughly mastered, so completely agreed upon, as to be *assumed;* that is to say, something taken as a matter of course without explicit statement. The familiar "it goes without saying" means "it is understood." If two persons can converse intelligently with each other, it is because a common experience supplies a background of mutual understanding upon which their respective remarks are projected. To dig up and to formulate this common background would be imbecile; it is "understood"; that is, it is silently sup-plied and im-plied as the taken-for-granted medium of intelligent exchange of ideas.

If, however, the two persons find themselves at cross-purposes, it is necessary to dig up and compare the presuppositions, the implied context, on the basis of which each is speaking. The im-plicit is made ex-plicit; what was unconsciously assumed is exposed to the light of conscious day.

In this way, the root of the misunderstanding is removed. Some such rhythm of the unconscious and the conscious, of going ahead and of analysis, is involved in all fruitful thinking. A person in pursuing a consecutive train of thoughts takes some system of ideas for granted (which accordingly he leaves unexpressed, 'unconscious') as surely as he does in conversing with others. Some context, some situation, some controlling purpose dominates his explicit ideas so thoroughly that it does not need to be consciously formulated and expounded. Explicit thinking goes on within the limits of what is implied or understood. Yet the fact that reflection originates in a problem makes it necessary *at some points* consciously to inspect and examine this familiar background. We have to turn upon some unconscious assumption and make it explicit.

No rules can be laid down for attaining the due balance and rhythm of these two phases of mental life. No ordinance can prescribe at just what point the spontaneous working of some unconscious attitude and habit is to be checked till we have made explicit what is implied in it. No one is wise enough to tell in detail just when and how far analytic inspection and conscious statement should be engaged in. We can say that they must be carried far enough so that the individual will know what he is about and be able to guide his thinking; but in a given case just how far is that? We can say that they must be carried far enough to detect and guard against the source of some false perception or reasoning, and to get a leverage on an investigation; but such statements only restate the original difficulty. Since our reliance must be upon the disposition and tact of the individual in the particular case, there is no test of the success of an education more important than whether it nurtures a type of mind that maintains a balance of the unconscious and the conscious.

The ways of teaching criticized in the foregoing pages as false 'analytic' methods of instruction, all reduce themselves to the mistake of directing explicit attention and formulation to what would work better if left an unconscious attitude and working assumption. To pry into the familiar, the usual, the automatic, simply for the sake of making it conscious, simply for the sake of formulating it, is both an impertinent interference and a source of boredom. To be forced to dwell consciously upon the accustomed is the essence of ennui. Methods of instruction that have that tendency dull curiosity.

On the other hand, what has been said in criticism of merely routine forms of skill, what has been said about the importance of having a genuine problem, of introducing the novel, and of reaching a deposit of general meaning weighs on the other side of the scales. It is fatal to good thinking to fail to make conscious the standing source of some error or recurring failure as well as to pry needlessly into what works smoothly. To over-simplify, to exclude the novel for the sake of prompt skill, to avoid obstacles for the sake of averting errors, is as detrimental as to try to get pupils to formulate everything they know and to state every step of the procedure by which a result was obtained. Where the shoe pinches, analytic examination is indicated. When a topic is to be clinched so that knowledge of it will carry over and be an effective resource in further topics, conscious summarizing and organization are imperative. In the early stage of acquaintance with a subject, a good deal of unconstrained unconscious mental play about it may be permitted, even at the risk of some random experimenting; in the later stages, conscious formulation and review may be encouraged. Projection and reflection, going directly ahead and turning back in scrutiny, should alternate. Unconscious-

ness gives spontaneity and freshness; consciousness, command and control.

An Illustration from Control of Reflective Thinking

The point may be illustrated by the analysis in this volume of the phases of reflective activity. Some readers may get the idea that it is intended that students in their study and recitation should be made consciously to note and formulate these various phases as a means of intellectual control. Such a notion is, however, foreign to the spirit of the analysis. For it holds that fundamental control is effected by means of the *conditions* under which students work — the provision of a real situation that arouses inquiry, suggestion, reasoning, testing, etc. The chief value of the analysis that has been given is therefore to suggest to teachers the ways in which reflective thought may be best secured in students without the latter being made conscious at every step of their own attitudes and processes. It is also true that, *after* the instructor has once provided the conditions most likely to call out and direct thinking, the student's subsequent activity, while conscious of ends and means, may be unconscious with respect to his own personal attitudes and procedures. The familiar fact that creative work in the arts, writing, painting, music, etc., is largely unconscious as to the motives and attitudes of the artist, his mind being fixed on the objects he is dealing with or constructing, suggests the adoption of a like course in both study and teaching. The artist should be taken as a model rather than the activities of one painfully conscious at every step of just how he is operating. Control should be exercised by the set-up of the situation itself. Yet in conditions of unusual perplexity or repeated error it will usually be a help if conscious attention goes back to such causes as lie in the attitudes and processes of the learner.

Absorption and Incubation

It is a common experience that after prolonged preoccupation with an intellectual topic, the mind ceases to function readily. It apparently has got into a rut; the 'wheels go around' in the head, but they do not turn out any fresh grist. New suggestions cease to occur. The mind is, as the apt expression goes, 'fed up.' This condition is a warning to turn, as far as conscious attention and reflection are concerned, to something else. Then after the mind has ceased to be intent on the problem, and consciousness has relaxed its strain, a period of incubation sets in. Material rearranges itself; facts and principles fall into place; what was confused becomes bright and clear; the mixed-up becomes orderly, often to such an extent that the problem is essentially solved. Many persons having a complicated practical question to decide find it advisable to sleep on the matter. Often they awake in the morning to find that, while they were sleeping, things have wonderfully straightened themselves out. A subtle process of incubation has resulted in hatching a decision and a plan. But this bringing forth of inventions, solutions, and discoveries rarely occurs except to a mind that has previously steeped itself consciously in material relating to its question, has turned matters off and over, weighed pros and cons. Incubation, in short, is one phase of a rhythmic process.

II. Process and Product

Play and Work Again

A like balance in mental life characterizes process and product. We met one important phase of this adjustment in considering play and work. In play, interest centers in ac-

tivity, without much reference to its outcome. The sequence of deeds, images, emotions, suffices on its own account. In work, the end holds attention and controls the notice given to means. Since the difference is one of direction of interest, the contrast is one of emphasis, not of cleavage. When comparative prominence in consciousness of activity or outcome is transformed into isolation of one from the other, play degenerates into fooling, and work into drudgery.

Play Should Not Be Fooling

By 'fooling' we understand a series of disconnected temporary overflows of energy dependent upon whim and accident. When all reference to outcome is eliminated from the sequence of ideas and acts that make play, each member of the sequence is cut loose from every other and becomes fantastic, arbitrary, aimless; mere fooling follows. There is some inveterate tendency to fool in children as well as in animals; the tendency is not wholly evil, for it militates against falling into ruts. Even indulgence in dreaming and fancies *may* give mind a start in a new direction. But when they are excessive in amount, dissipation and disintegration follow; and the only way of preventing this result is to see to it that the children look ahead and forecast, to some extent, the ends of their activity, the effects it is likely to produce.

Work Should Not Be Drudgery

However, *exclusive* interest in a result alters work to drudgery. For by drudgery is meant those activities in which the interest in the outcome does not suffuse the process of getting the result. Whenever a piece of work becomes drudgery, the process of doing loses all value for the doer; he cares solely for what is to be had at the end of it. The work itself, the putting forth of energy, is hateful; it is

just a necessary evil, since without it some important end would be missed. Now, it is a commonplace that in the work of the world many things have to be done, the doing of which is not intrinsically very interesting. However, the argument that children should be kept doing drudgery tasks because thereby they acquire power to be faithful to distasteful duties is wholly fallacious. Repulsion, shirking, and evasion are the consequences of having the repulsive imposed — not loyal love of duty. Willingness to work for ends by means of acts not naturally attractive is best attained by securing an appreciation of the value of the end, so that a sense of its value is transferred to its means of accomplishment. Not interesting in themselves, they borrow interest from the result with which they are associated.

Balance of the Work Attitude and the Play Attitude

The intellectual harm accruing from divorce of work and play, product and process, is evidenced in the proverb, "All work and no play makes Jack a dull boy." That the obverse is true is perhaps sufficiently signalized in the fact that fooling is so near to foolishness. To be playful and serious at the same time is possible, and it defines the ideal mental condition. Absence of dogmatism and prejudice, presence of intellectual curiosity and flexibility, are manifest in the free play of the mind upon a topic. To give the mind this free play is not to encourage toying with a subject, but is to be interested in the unfolding of the subject on its own account, apart from any subservience to a preconceived belief or habitual aim. Mental play is open-mindedness, faith in the power of thought to preserve its own integrity without external supports and arbitrary restrictions. Hence free mental play involves seriousness, the earnest following of the development of subject matter. It is incompatible with carelessness or flippancy, for it exacts

accurate noting of every result reached in order that every conclusion may be put to further use. What is termed the 'interest in truth for its own sake' is certainly a serious matter, yet this pure interest in truth coincides with love of the free play of thought in inquiry.

In spite of many appearances to the contrary — usually due to social conditions either of superfluity of means that induces idle fooling or of undue economic pressure that compels drudgery — childhood normally realizes the ideal of conjoint free mental play and thoughtfulness. Successful portrayals of children have always made their wistful intentness at least as obvious as their lack of worry for the morrow. To live in the present is compatible with condensation of far-reaching meanings in the present. Such enrichment of the present for its own sake is the just heritage of childhood and the best insurer of future growth. The child forced into premature concern with economic remote results may develop a surprising sharpening of wits in a particular direction, but there is danger that this precocious specialization will be paid for by later apathy and dullness.

The Attitude of the Artist

That art originated in play is a common saying. Whether or not the saying is historically correct, it suggests a harmony of mental playfulness and seriousness that describes the artistic ideal. When the artist is preoccupied overmuch with means and materials, he may achieve wonderful technique, but not the artistic spirit *par excellence*. When the animating idea is in excess of the command of method, æsthetic feeling may be indicated, but the art of presentation is too defective to express the feeling thoroughly. When the thought of the end becomes so adequate that it compels translation into the means that embody it, or when attention to means is inspired by recognition of the end they

serve, we have the attitude typical of the artist, an attitude that may be displayed in all activities, even though they are not conventionally designated 'arts.'

The Teacher as an Artist

That teaching is an art and the true teacher an artist is a familiar saying. Now the teacher's own claim to rank as an artist is measured by his ability to foster the attitude of the artist in those who study with him, whether they be youth or little children. Some succeed in arousing enthusiasm, in communicating large ideas, in evoking energy. So far, well; but the final test is whether the stimulus thus given to wider aims succeeds in transforming itself into power; that is to say, into the attention to detail that ensures mastery over means of execution. If not, the zeal flags, the interest dies out, the ideal becomes a clouded memory. Other teachers succeed in training facility, skill, mastery of the technique of subjects. Again it is well — so far. But unless enlargement of mental vision, power of increased discrimination of final values, a sense for ideas, for principles, accompanies this training, forms of skill ready to be put indifferently to any end may be the result. Such modes of technical skill may display themselves, according to circumstances, as cleverness in serving self-interest, as docility in carrying out the purposes of others, or as unimaginative plodding in ruts. To nurture inspiring aim and executive means into harmony with each other is at once the difficulty and the reward of the teacher.

III. The Far and the Near

'Familiarity Breeds Contempt'

Teachers who have heard that they should avoid matters foreign to pupils' experience are frequently surprised to find

pupils wake up when something beyond their ken is introduced, while they remain apathetic in considering the familiar. In geography the child upon the plains seems perversely irresponsive to the intellectual charms of his local environment, but fascinated by whatever concerns mountains or the sea. Teachers who have struggled with little avail to extract from pupils essays describing the details of things with which they are well acquainted sometimes find them eager to write on lofty or imaginary themes. A woman of education, who has recorded her experience as a factory worker, tried retelling *Little Women* to some factory girls during their working hours. They cared little for it, saying, "Those girls had no more interesting experience than we have," and demanded stories of millionaires and society leaders. A man interested in the mental condition of those engaged in routine labor asked a Scotch girl in a cotton factory what she thought about all day. She replied that, as soon as her mind was free from starting the machinery, she married a duke, and their fortunes occupied her for the remainder of the day.

Naturally, these incidents are not told in order to encourage methods of teaching that appeal to the sensational, the extraordinary, or the incomprehensible. They are told, however, to enforce the point that the familiar and the near do not excite or repay thought on their own account, but only as they are adjusted to mastering the strange and remote. It is a commonplace of psychology that we do not attend to the old or consciously mind that to which we are thoroughly accustomed. For this there is good reason; to devote attention to the old, when new circumstances are constantly arising to which we should adjust ourselves, would be wasteful and dangerous. Thought must be reserved for the new, the precarious, the problematic. Hence the mental constraint, the sense of being lost, that comes to pupils when they are

invited to turn their thoughts upon that with which they are already familiar. The old, the near, the accustomed, is not that *to* which but that *with* which we attend; it does not furnish the material of a problem, but of its solution.

Balancing the New and the Old

The last sentence has brought us to the balancing of new and old, of the far and that close by, involved in reflection. The more remote supplies the stimulus and the motive; the nearer at hand furnishes the point of approach and the available resources. This principle may also be stated in this form: the best thinking occurs when the easy and the difficult are duly proportioned to each other. The easy and the familiar are equivalents, as are the strange and the difficult. Too much that is easy gives no ground for inquiry; too much that is hard renders inquiry hopeless.

The necessity of the interaction of the near and the far follows directly from the nature of thinking. Where there is thought, something present suggests and indicates something absent. Accordingly, unless the familiar is presented under conditions that are in some respect unusual, there is no jog to thinking; no demand is made upon hunting out something new and different. And if the subject presented is totally strange, there is no basis upon which it may suggest anything serviceable for its comprehension. When a person first has to do with fractions, for example, they will be wholly baffling so far as they do not signify to him some relation that he has already mastered in dealing with whole numbers. When fractions have become thoroughly familiar, his perception of them acts simply as a signal to do certain things; they are a 'substitute sign,' to which he can react without thinking.[1] If, nevertheless, the situation as a whole presents something novel and hence uncertain, the entire

[1] See page 238.

response is not mechanical, because this mechanical operation is put to use in solving a problem. There is no end to this spiral process: foreign subject matter transformed through thinking into a familiar possession becomes a resource for judging and assimilating additional foreign subject matter.

Observation Supplies the Near, Imagination the Remote

The need for both imagination and observation in every mental enterprise illustrates another aspect of the same principle. Teachers who have tried object lessons of the conventional type have usually found that, when the lessons were new, pupils were attracted to them as a diversion, but as soon as they became matters of course, they were as dull and wearisome as was ever the most mechanical study of mere symbols. Imagination could not play about the objects so as to enrich them. The feeling that instruction in 'facts, facts' produces a narrow Gradgrind is justified, not because facts in themselves are limiting, but because facts are dealt out as hard and fast ready-made articles. No room is left to imagination. Let the facts be presented so as to stimulate imagination, and culture ensues naturally enough. The converse is equally true. The imaginative is not necessarily the imaginary; that is, the unreal. The proper function of imagination is vision of realities and possibilities that cannot be exhibited under existing conditions of sense perception. Clear insight into the remote, the absent, the obscure is its aim. History, literature, and geography, the principles of science, nay, even geometry and arithmetic, are full of matters that must be imaginatively realized if they are realized at all. Imagination supplements and deepens observation; only when it turns into the fanciful does it become a substitute for observation and lose logical force.

A final exemplification of the required balance between

near and far is found in the relation that obtains between the narrower field of experience realized in an individual's own contact with persons and things, and the wider experience of the race that may become his through communication. Instruction always runs the risk of swamping the pupil's own vital, though narrow, experience under masses of communicated material. The mere instructor ceases and the vital teacher begins at the point where communicated matter stimulates into fuller and more significant life that which has entered by the strait and narrow gate of sense perception and motor activity. Genuine communication involves contagion; its name should not be taken in vain by terming communication that which produces no community of thought and purpose between the child and the race of which he is the heir.

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